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27 June 1983

Worldwide Report

ENVIRONMENTAL QUALITY

No. 403

CHINA ADDRESSES ENVIRONMENTAL ISSUES -- V

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PRC OFFICIAL ADDRESSES UN ENVIRONMENT MEETING

OW162026 Beijing XINHUA in English 1510 GMT 16 May 83

[Text] Nairobi, May 16 (XINHUA) -- The Chinese Government is opposed to the immoral practice of dumping pollutants to neighbours and calls for the establishment of a new international economic order to create a sound natural environment of the world.

This stand was expounded by head of the Chinese delegation to the eleventh session of the governing council of the United Nations Environment Program, Yang Keming, at a plenary meeting here today.

Yang said acid rain which has spread over almost the entire world has become one of the most crucial problems and the Chinese Government "is, as always, opposed to the immoral practice of protecting one's own interests at the expense of others by dumping pollutants to one's neighbours."

"The problem of the contamination and damage by acid rain can only be solved by eliminating its root source, that is, through applying advanced techniques such as desulphurizing and washing reprocessing during the course of exploitation, utilization and combustion of various forms of energy, especially coal," he said.

It is vital for the developing countries to restore a balanced agricultural ecosystem, he said, adding that "to achieve this goal, it is imperative to solve the rural energy problem and to develop some new models of production and new energy substitutes."

Based on Chinese experiences, he advocated the development of new forms of energy sources in rural areas in line with local conditions, such as solar energy, biogas, wind power, small hydro-power stations and fast-growing fuel-wood to alleviate the shortage of energy.

"The developed countries should make concrete contributions to helping developing countries solve their environmental problems. At the same time, developing countries have their own successful experience in solving their respective environmental problems, and therefore there are many areas for extensive cooperation among themselves," he said.

CSO: 5000/4171

NATIONAL URBAN ENVIRONMENT MEETING OPENS

Sanitation, Landscape Workers

OW190158 Beijing Domestic Service in Mandarin 1000 GMT 14 Mar 83

[Text] A national meeting of representatives of advanced collectives and persons in urban environmental sanitation and landscaping opened in Beijing this morning. The meeting is sponsored by the Ministry of Urban and Rural Construction and Environmental Protection and the National Committee of the Chinese Architectural Workers Trade Union with the approval of the State Council. The meeting is the first of its kind ever held since the founding of the People's Republic of China. In his opening speech, Li Ximing, minister of the Ministry of Urban and Rural Construction and Environmental Protection, expressed his warm welcome to the representatives of advanced collectives and those who came to Beijing from the forefront of environmental sanitation and landscaping of various localities.

He said: You work in the forefront of environmental sanitation and landscaping year in and year out. You have made great efforts and contributions in cleaning, greening and beautifying the urban areas and in improving the urban environment. Your workposts are honorable and your undertakings are sublime. Your hard work is highly praised and respected by the party and the people. The people, the party and the government thank you.

This meeting is being held to commend your contributions, spread your experience and impel the broad masses of workers and staff on the environmental sanitation and landscaping front to learn from the advanced, actively carry out reforms, and create a new situation in the environmental sanitation and landscaping work.

(Lian Zhong), vice minister of the Ministry of Urban and Rural Construction and Environmental Protection, also addressed the meeting. He called on all cities to adhere to the principle of landscaping the city, improving environments, serving the present generations and benefiting future generations; to concentrate on improving environments, promoting community efforts and enhancing economic results; and to bring into play the initiative of all fronts to improve the appearance of our cities.

He said: Before the end of the century we should green all urban areas that can be greened, mechanize all environmental sanitation work and dispose of garbage in a satisfactory way. By then, we should increase the number of major scenic spots in our country to 80 and that of general scenic spots to 500.

All localities attach great importance to this meeting. When the representatives were leaving their posts for Beijing they were seen off by the responsible comrades of various provinces, municipalities and autonomous regions at railroad stations or airports.

Wan Li Attends

OW200948 Beijing XINHUA Domestic Service in Chinese 1458 GMT 18 Mar 83

[By RENMIN RIBAO reporter Lu Mu and XINHUA reporter Ding Genxi]

[Excerpts] Beijing, 18 Mar (XINHUA) -- At a national meeting of representatives of advanced collectives and individuals engaged in urban environmental sanitation and park greening, party and state leaders this afternoon presented citation banners, prizes and citation albums to 32 advanced units and 69 model workers that had made outstanding achievements in beautifying cities.

Wan Li, Chen Muhua, Gu Mu, Hu Qili, Hao Jianxiu and Kang Keqing attended the award ceremony and had group pictures taken with those present.

On behalf of the party Central Committee and the State Council, Wan Li, member of the CPC Central Committee Political Bureau and vice premier of the State Council, extended respects to workers and staff members engaged in the work of urban environmental sanitation and park greening throughout the country. He said: Urban environmental sanitation and park greening are great undertakings concerning the fundamental interests of hundreds of millions of people. An important aspect in building a socialist material and a socialist spiritual civilization and carrying on "All-People Civility and Courtesy Month" activities is to create a clean and beautiful environment in which people can undertake socialist modernization with ease of mind. In today's society, however, some people still do not pay any attention to the work of environmental sanitation and park greening, and think that cleaning the street and planting flowers and grass are insignificant matters. Others even hold that removing garbage and nightsoil, cleaning the street and planting grass and flowers are inferior occupations. Such views are all wrong: Environmental sanitation and gardening are glorious occupations that should be respected by the whole society.

Wan Li pointed out: The key to bringing about a new situation in the work of beautifying cities and parks lies in strengthening our leadership. As far as a city is concerned, the main duty of the city party committee and city government, especially its mayor, is to do a good job in urban planning, construction and management.

The city leadership should put environmental sanitation and park greening as important items on the agenda of the city party committee and city government, discuss these items seriously, make unified arrangements for the work in these matters, constantly supervise the work and timely solve problems that emerge. At the same time, further efforts should be made to solve problems in management. Otherwise, the situation would be one in which "a few people clean the streets while many others litter the streets," and many trees and flowers and a lot of grass are planted but few of them survive. In that case, it would be very difficult to ever significantly change the appearance of our cities. To strengthen management in these regards it is necessary to step up the work of laying down laws and regulations, and to strictly enforce them so that laws and regulations will not be formulated for no purpose.

In conclusion Wan Li said: Working conditions for large numbers of workers and staff members engaged in the work of environmental sanitation and park greening are rather hard. Leaders at various levels should cherish their initiative and do everything possible to continuously improve their working and living conditions. They should think of ways to practically do good turns for workers and staff members engaged in the work of environmental sanitation and park greening.

CSO: 5000/4170

SPEECH BY LI XIMING AT NATIONAL CONFERENCE ON ENVIRONMENTAL PROTECTION WORK

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983 pp 2-7

[Minutes of Speech by Li Ximing [2621 6932 6900], Minister of Urban and Rural Construction and Environmental Protection: "Strive to Open Up New Prospects for Environmental Protection Work Under the Spirit of the Twelfth Congress of the Chinese Communist Party"]

[Text] The tasks of the current session on environmental protection work are primarily to carry out the spirit of the Twelfth Congress of the Chinese Communist Party and the Fifth Session of the Fifth National People's Congress, study ways of opening up new prospects for strategic goals, strategic keypoints and strategic measures for environmental protection, and discuss next year's work agendum.

The Twelfth Congress of the Chinese Communist Party drew up a comprehensive and magnificent program for opening up new prospects for socialist modernization and construction, and put forward a combat target calling for efforts to quadruple the annual gross output of our country's industry and agriculture by the end of this century on the precondition that there are continuous improvements in economic results. The Fifth Session of the Fifth National People's Congress passed the new Constitution and the Sixth Five-Year Plan for the development of our nation's economy and socialism, thus providing the most essential legal guarantee and first-step plans for materializing the magnificent program formulated at the Twelfth Congress of the Communist Party. We must earnestly carry out the spirit of these two congressional sessions, and do our utmost to materialize the glorious tasks entrusted to us by the Party and people; environmental protection work must keep pace with economic construction. While expediting the materialization of economic construction goals, we should also open up new prospects for China's environmental construction.

Brace up and Strengthen Confidence in Opening up New Prospects

At present, China's socialist modernization construction has already entered a new phase, and everyone agrees that the situation is extremely favorable on all fronts. What is the situation in environmental work? It has been almost a decade since our country began environmental work. Over the past ten years, we have overcome difficulties and continuously progressed;

we have already laid down the preliminary basis for work, and the situation is also extremely favorable.

First of all, the Communist Party and state Government are attaching more and more importance to environmental protection and ecological balance. The broad ranks of cadres and masses have gradually improved their level of understanding. Since the Third Plenary Session of the Eleventh Congress of the Chinese Communist Party, the Party Central Committee and State Council have come up with a series of important directives and resolutions regarding environmental protection. In his report at the Twelfth Congress of the Chinese Communist Party, Comrade Hu Yaobang [5170 5069 6721] declared the protection of all kinds of agricultural resources and maintenance of ecological balance as a strategic keypoint. The Fourth Session of the Fifth National People's Congress endorsed ten economic construction guidelines which put special emphasis on environmental protection and included specific requirements as well. In his "Report on the Sixth Five-Year Plan" at the Fifth Session of the Fifth National People's Congress, Comrade Zhao Ziyang clearly indicated that it was imperative to resolutely check further development of environmental pollution and improve the environment of major regions.

Recently, Comrade Chen Yun [7115 0061] issued important directives with regard to the acid rain problem in Shanghai: "Priority must be given to the funding of control work. Otherwise, there will be no end of trouble in the future." Subsequently, Comrade Zhao Ziyang also issued some timely instructions to our Ministry with regard to the acid rain problem. All this indicates that the Party and Government attaches immense importance to environmental protection, and that the way to open up new prospects for environmental protection work has been clearly shown.

Second, tremendous progress has been made in the formulation of environmental protection laws. Since 1979, the National People's Congress and State Council have promulgated a series of environmental protection laws: "The Environmental Protection Law of the People's Republic of China (Trial Implementation)," "Regulations on Water and Soil Conservation Work," etc. Provisions on environmental protection and ecological balance are stipulated in the "Forest Law of the People's Republic of China (Trial Implementation)" which has already been promulgated, and the "Grasslands Law," "Water Resources Law," and "Mineral Resources Law" which are currently being drafted. Other laws that are being drawn up or going through the legislative process include the "Water Pollution Prevention and Control Law," "Air Pollution Prevention and Control Law," "Urban Noise Control Law," and "Regulations on Natural Conservation Regions." Thus, we are gradually amplifying laws and regulations for environmental protection.

The most encouraging development is that the environmental protection provisions are further substantiated in the new Constitution endorsed at the Fifth Session of the Fifth National People's Congress. Now that the legal status of environmental protection has been established in the overall fundamental law of the state which has the highest authority and supreme legal power, it is bound to add tremendous impetus to the further development of environmental protection work.

Third, environmental protection is beginning to be included in plans for the national economy and social development. Endorsed at the Fifth Session of the Fifth National People's Congress, the Sixth Five-Year Plan has a special section on environmental protection, including the basic goals, tasks and chief measures of environmental protection work. Moreover, for long-term planning, it has also taken into account the mutual dependence and interaction between population, resources, environment and development embodied in the relations between economic growth, scientific and technological development, and social growth; it contains strategic ideas calling for combined and coordinative development. In the past one or two years, the Party and Government have formulated many new economic policies calling for unification of economic results and environmental results, which is extremely favorable to environmental protection work. The Eight Point Policy for adjustment of the national economy should be carried out; some enterprises are to be restructured, shut down, suspended, merged or shifted; old enterprises need technical transformations; both the utilization rate and comprehensive utilization level of resources and energy sources should be improved. In agriculture, we should carry out the policy of "never slacken efforts in food production, and energetically develop many kinds of businesses." Based on the laws of nature, practice scientific ways of farming, protect forests and grasslands, prevent and control water and soil runoff, stop unchecked reclamation of wasteland and marshland. These are all conducive to economic growth, as well as the ecological balance of environmental protection.

Fourth, a feasible way has been found for the prevention and control of industrial pollution. All regions and governmental departments are trying to implement Comrade Zhao Ziyang's directives based on the Anshan Iron and Steel Company's experiences in self-reliance, comprehensive utilization of resources and energy sources, and control of the "three wastes." A number of advanced organizations which are noted for their excellent economic results and remarkable achievements in pollution control and environmental protection have appeared on the scene. Their fundamental experiences are: Through technical transformations, first improve the utilization rate of resources and energy resources, strive hard to eliminate the "three wastes" in production, and get rid of industrial pollutants. Next, through comprehensive utilization, turn the discharged "three wastes" into resources, i.e., convert waste into treasure, and turn harm into good. On this basis, continue to look for technically advanced, economically rational, and effective purification measures to purify and process smoke, industrial waste gases, and wastewater contaminated by toxic heavy metals, i.e., pollutants which have to be discharged and cannot be solved at the moment through technical transformations or comprehensive utilization should meet emission standards of the state. In addition, in conjunction with the current drive to restructure enterprises, it is also important to strengthen business management and administration, incorporate environmental protection into the economic system of job responsibility, and implement effective environmental management measures. It has been proven by numerous practical experiences that this is an economical and effective way to produce good environmental results and promote production at the same time. So as long as we firmly adhere to this path, radical improvements are bound to occur in the prevention and control of industrial pollution.

Fifth, administrative bodies have been set up by state and local governments and concerned departments at all levels to enhance supervision of environmental protection work. Fairly great developments have also been achieved in environmental monitoring, environmental research and development, and environmental education.

All of the above constitute favorable conditions which are essential and of far-reaching consequences. It should be pointed out that quite a few achievements in environmental protection work have been accomplished through everyone's efforts. But we should also recognize the fact that in general, environmental pollution and ecological breakdown are still very serious, and that the continuously deteriorating trend has not been checked yet. Environmental protection work faces extremely arduous and difficult tasks ahead. On the basis of what we have already achieved, we must strengthen confidence, surmount difficulties and continue to march onward.

Environmental protection work is very important work which involves the overall national economy. We have just begun, and there are many things which we have not been able to do yet. Thus, it is important to rely on all branches of industries and all departments, and allow them to really become involved in the work when implementing the economic system of job responsibilities. We must also further enhance the strength of the Ministry of Environmental Protection and assume the responsibilities of overall planning, coordination, organization, supervision and inspection.

Formulate the Strategic Goals of Environmental Construction On the Basis of the Strategic Goals of Economic Development

The strategic goals, strategic keypoints, strategic measures and a series of correct guidelines for our country's economic construction were formulated at the Twelfth Congress of the Chinese Communist Party. Environmental construction must observe the principle of synchronizing and coordinating with economic construction, and it must formulate corresponding strategic goals, keypoints and measures.

Our preliminary ideas of the strategic goals of China's environmental construction are: By the year 2000, basically solve the whole country's environmental pollution and ecological breakdown problems; strive to provide urban and rural people with a clean and pleasant working and living environment; restore all natural ecological environments to a healthy state; basically satisfy the needs of the national economic growth for natural resources; and basically meet the living standards for a comfortable material and cultural life of the people.

To materialize the preceding strategic goals of environmental construction, it is important to regard solving the industrial pollution problem, and building natural ecological balance, especially agricultural, forestry and river system problems as strategic keypoints.

The strategic measures consist of two steps: The first ten years are to be primarily devoted to stopping the increasingly serious environmental pollution

and breakdown of the ecological balance. The next ten years will be spent on overall environmental construction and basically solve China's environmental problems.

During the Sixth Five-Year Plan period, efforts should be made to meet the requirements put forward by Comrade Zhao Ziyang at the Fifth Session of the Fifth National People's Congress: "Resolutely check further development of environmental pollution and improve the environment of major regions." First, we must stricly control the generation of new pollution sources. When carrying out such engineering projects as construction remodelling and extension, it is important to persist in the system of reporting on environmental impacts, and adhere to the principle of fulfilling the "three simultaneous efforts".

Moreover, steps should be taken to control pollution in old enterprises, and help our industries to greatly enhance their ability to process the "three wastes" and make comprehensive use of resources. Prior to 1985, factories and mines are to be equipped with the capability to process wastewater contaminated by mercury, chromium, cadmium, etc. which are not to be discharged into rivers, lakes or seas. In environmental protection, we must prevent ecological breakdowns caused by the development of agriculture, forestry, water resources, energy sources and communication. Steps should be taken to strengthen the construction and management of natural conservation regions. We should continue to implement the State Council's 1981 "Resolution on Enhancing Environmental Protection Work During the National Economy Adjustment Period" when improving the environmental conditions of major regions, i.e., focus on serious pollution problems in heavily populated areas, water conservation areas, and scenic and tourist spots. Nationwide efforts will be made to achieve the following within three or five years: Make marked improvements in Beijing's environmental conditions; bring the levels of polluted water, dust fall, sulfur dioxide and noise in such famous scenic and tourist spots as Suzhou, Hangzhou and Guilin down to the standards of environmental quality, and restore the natural state of these places. Attention should also be focused on environmental control and environmental protection in one or two local cities of each province and autonomous region, and make marked improvements in their environmental quality.

Of course, these are only preliminary ideas. As to whether or not they are practical, effective and feasible--these questions are open to serious study, discussions, amendments and additions at this conference. It is hoped that through our conference, we can pool together everyone's ideas determine the strategic goals, strategic keypoints and strategic plans for environmental construction, and firmly implement them in future work, thus raising our country's environmental protection work to a new level.

Some Problems in Opening Up New Prospects in Environmental Protection Work

In order to realize the strategic goals of environmental protection and open up new prospects for environmental protection work, we think it is necessary to solve the following problems:

First, define the guiding ideology and elevate our understanding to a new plane.

We must make clear that the purpose of environmental protection is to materialize socialist modernization. Our task is to promote economic growth, help quadruple the gross output of industry and agriculture, and create basic conditions for developing economic construction. To a great extent, our efforts to quadruple gross output will be restricted by environmental conditions and resources. For example, industrial and agricultural development will be somewhat limited if we fail to protect or utilize water resources, or fail to conserve the soil and vegetation of forestlands, or fail to protect agro-ecological conditions, or fail to make comprehensive use of energy sources and all kinds of mineral resources; consequently, our efforts to quadruple gross output will be hampered. The successful outcome of protection work will be of tremendous help to realizing four-fold increases in gross output. Thus, as far as guiding ideology is concerned, we must be very clear that the strategic departing point of environmental protection consists of unifying environmental results with economic results through rational exploitation and utilization of natural resources, and by enhancing the regenerative and reproductive powers of resources, as well as increasing the capacity of utilizing resources perpetually. We must effectively implement such ideas as having environmental protection serve production and construction, serve the cause of quadrupling gross output, and serve the fundamental interests of the people. The only way to gain new impetus and open up new work prospects is by closely linking up environmental protection work with the strategic goals of China's economic construction.

Second, produce high-quality forecasts on the environment; formulate and seriously implement environmental plans.

Today, as new prospects are opening up on every front, all regions and concerned sectors will need to forecast environmental development trends in accordance with the goal to quadruple industrial and agricultural gross output within twenty years, and come up with ways to prevent further deterioration of the environment and improve the quality of the environment. High-quality forecasts on the environment not only enables economy policy makers to take into consideration ways of dealing with possible environmental problems and thus avoid mistakes, they also provide important bases for formulating environmental plans, thus minimizing irrational decisions. For instance, China mainly relies on coal for fuel, and 600 million tons of coal are produced annually now. Owing to the backward state of coal production and utilization techniques, plus the fact that we are also lagging behind in pollution control measures, cities all over the country are plagued with serious air pollution, and some places are affected by acid rain. By the year 2000, China's coal output will reach 1.2 billion tons. How will the environment be affected then? Moreover, in order to quadruple gross output, we must be in a position to produce scientific predictions on such major problems as whether there are sufficient resources, especially water resources, and how to solve the problem; whether the environmental capacity can tolerate the great increases in pollutants, etc.

We must be able to come up with strategies as early as possible. This type of work is fairly complex; we must organize people with technical know-how and put in a tremendous amount of effort.

On the basis of environmental forecasting, we should draw up an environmental protection program and include it in plans to be implemented. The immediate-term program for environmental protection is already incorporated in the entire nation's Sixth Five-Year Plan. What needs to be done now is to further formulate a seventh five-year program for environmental protection, and a twenty-year program outline. Such an undertaking cannot be achieved by us alone, as it requires the concerted efforts of all regions and all concerned sectors. The industrial sectors should formulate environmental protection programs when formulating development plans for their industries; all regions should do likewise when formulating their own plans for economic, social, and scientific and technical development. All major enterprises should formulate programs for pollution prevention and control when drawing up production development and technical transformation plans. People's Liberation Army units should formulate environmental protection programs in accordance with their own particular circumstances. The programs should be promptly incorporated into the economic programs and plans of the nation, regions, sectors and enterprises, and serious efforts should be made to ensure implementation of the programs and plans.

Third, while focusing on regional economic programs, protect urban environments and natural environments through overall planning.

In his report on the Sixth Five-Year Plan, Comrade Zhao Ziyang proposed unifying production and circulation, centering on the more economically developed cities so as to carry along the surrounding rural areas and gradually form city-based economic zones of different sizes and types. This is a direction. The State Council has decided to first develop pilot economic zones centered around Shanghai and the Shanxi Coal Base, and gradually extend it to other parts of the country. With the construction of economic zones, especially the development of industries, the task of preventing and controlling urban environmental pollution will become increasingly heavier. Thus, while building economic zones and cities, it is imperative to make sure that the planning, implementation and development of urban construction, economic construction and environmental construction are all synchronized. It is also important to gradually adjust the distribution of industries in coordination with the reorganization and merging of enterprises. In urban environmental construction, we should follow the principle of "emphasizing prevention, combining prevention and control, and tackling problems in a comprehensive way," thus unifying economic results, social results and environmental results. When building or remodeling cities, we should include pollution prevention and control projects as well as all sorts of basic construction projects; develop centralized heating and coal gasification; build parks and plant trees.

Protecting natural environments is an important responsibility of environmental protection departments. Environmental protection departments at all levels should actively coordinate with concerned sectors, and stress the

following tasks: First, emphasize agro-ecological protection, and help promote the benign cycle of agro-ecological systems. Second, stress the protection of water resources. The protection and utilization of water resources is a major state policy. We should not merely prevent and control water pollution; what is even more important, we should properly develop and utilize water resources. Third, in major resources development projects, efforts should be made to carefully evaluate environmental impact, so as to prevent a breakdown of natural ecological systems. Fourth, protect marine resources, especially against contamination of the sea by petroleum development. Fifth, protect biological resources, and enhance protection of rare wildlife species by building in a planned way various ecological types of natural conservation areas that are conducive to the multiplication and conservation of the species. As we lack experience in natural environmental protection work, we have to put a lot of effort into surveys, research, summing up experiences, and exploring for ways; we must develop this area of work as soon as possible.

From now on, the focal point of environmental protection in industrially centralized cities should be solving industrial pollution and comprehensive control problems. Prefectures and counties which are not seriously affected by pollution should place the focal point on natural environment conservation, especially the protection of agricultural environment, including preventive and control measures against pollution caused by enterprises run by communes and brigades.

Fourth, energetically promote scientific and technical progress of environmental protection.

While trying to modernize, vigorously develop the economy, and quadruple the output, we must rely on the progress of science and technology. The successful outcome of environmental projection and environmental construction also depends on the progress of science and technology. This is an issue of strategic importance. Scientific and technical research projects of environmental protection should focus on techniques which can be applied towards the prevention and control of environmental pollution and ecological breakdown. Chief projects include: Finding ways and feasible techniques for comprehensive prevention and control of environmental pollution and breakdown; developing environmental management science, ways to forecast environmental pollution and breakdown, as well as methods and instruments for monitoring and studying the environment. Immediate measures should be taken to organize scientific and technical forces to tackle with the vital and urgent acid rain problem. While devoting our attention to these focal points, it is also important to predict scientific and technical problems which may appear in the environmental protection field by end of this century, and thus choose subjects for long-term research work. In addition, basic research which can provide theories for guiding practical environmental protection work should be continued.

Environmental management is a multidisciplinary science; it is a science which studies the macroscopic, strategic, overall and planning aspects of environmental protection, and includes environmental planning, environmental

protection strategies, major environmental and economic policies, environmental management theories and methods, environmental economics, etc. At present, our strength in this area is too weak as we lack qualified personnel to begin with. I urge those comrades who are involved in in social sciences research to become actively concerned with environmental management science and participate in research work in this area. I also urge those comrades who are trained in science and engineering and are currently engaged in environmental protection work to spend a little time on studying social sciences, and conduct research on environmental management science.

Scientific and technical research in environmental protection involves a broad area which requires division of work plus coordination. In order to allow the environmental protection science and development organizations of each sector to focus on certain aspects and thus make better use of their own strong points, the following division of work is proposed for your consideration: Organizations under the Chinese Academy of Sciences should concentrate their research efforts on basic theories and application basis related to environmental protection institutions of higher education should focus on application basis research and development of new techniques; all sectors should concentrate their research efforts on pollution prevention and control techniques for their own particular branches of industry, and stress comprehensive utilization, pollution source monitoring as well as rules and regulations relevant to the prevention and control of environmental pollution and breakdowns in their own sector; organizations affiliated with the Chinese Academy of Social Sciences should emphasize research on environmental laws, environmental economics, population and environment, resources and environment; the scientific research academy of institutes under the Ministry of Environmental Protection should concentrate on studying national and regional environmental protection guidelines, policies, regulations, standard systems, environmental quality, protection of resources and comprehensive prevention and control techniques for local environments. Regional environmental research institutes should depart from actual local conditions and form their own characteristics.

Fifth, strengthen environmental management, and supervise inspections.

Enhancing environmental management is an important step towards opening up new prospects for environmental protection work. Environmental management should be based on environmental laws. In recent years, some environmental laws have been promulgated and implemented by state and local level authorities, but the laws are far from complete. We must, therefore, seriously strengthen the construction of an environmental law system, begin to amend environmental protection laws, formulate various laws and regulations, formulate and amend relevant environmental standards, and strive to build a preliminary environmental law system and environmental standard system for our country within three or five years. Our Ministry and all provinces, municipalities and autonomous regions are to draw up an agenda for formulating national and local environmental laws, and make year-by-year arrangements according to the order of priorities. Each law and regulation must be backed up by effective measures with binding force.

Environmental management must be guaranteed by correct environmental policies. We should continue to study and formulate environmental policies on urban and rural construction, industrial and agricultural development, development and utilization of resources and energy sources. Environmental policies must embody the nation's economic construction guideline. In accordance with the principle of unifying environmental results and economic results, environmental policies should allow economic development and environmental protection to coordinate with each other, and allow environmental protection to become a kind of positive and active element which can help promote economic growth.

The responsibility of environmental management departments is to organize coordination and supervise inspections. Through a series of directives and resolutions, the Central Committee of the Chinese Communist Party and State Council have specifically authorized the Environmental Protection Ministry with the power to undertake environmental management responsibilites and supervise inspections. We must exercise our functions and powers seriously. At present, we lack efficient management in the following areas: strictly implementing the "three simultaneous efforts", examining and approving reports on environmental impact; controlling the environment of old enterprises within specific time frames; organizing environmental monitoring; charging fines for violation of standards, etc. Up to now, some regions have not even started einvronmental management work at all. It is hoped that our environmental management departments at all levels can achieve the following: First, brace up and dare to hold the reins of management. Besides supervising inspections and helping to promote things, it is also important to be helpful and cooperative with departments concerned, and solve practical difficulties for the grassroots. Second, attach importance to methods, and take the initiative. It is especially important that we take the initiative in getting guidance from higher-level Party and Government offices, try to gain the support of planning, financial and economic ministries, and coordinate well with concerned organizations. Third, we should do our best in propaganda and educational work, continuously explain to the leadership and broad masses of the people about the close links between successful environmental protection and accelerating the pace of economic construction. Here, we should also emphasize the strengthening of monitoring work as it provides a basis for environmental management. The monitoring posts in various regions have reached a preliminary scale; irrespective of whatever changes that may take place in environmental protection organizations at all levels, the monitoring post setup will continue to be enhanced and their work performance will continue to improve; a monitoring network will be gradually completed and provide timely and accurate data, and thus serve environmental management effectively.

Sixth, continuously sum up experiences and emphasize models.

Correct guidelines, policies and measures all come from practice; they all originate from the grassroot level. Thus, environmental protection organizations at all levels should often go into the thick of practice; they should conduct surveys and studies, look for models, carry out pilot

projects, sum up and popularize experiences. When the Capital Steel Works implemented the economic system of job responsibilities, it not only managed to greatly improve economic results, but also began environmental protection work in no time; tremendous changes have taken place in its production outlook and environmental outlook. The Anshan Iron and Steel Company also achieved fairly good combined economic and enviromental results by combining technological transformation with comprehensive utilization. The popularization of their experiences has helped to greatly promote industrial pollution prevention and control work.

At present, while stressing natural environmental protection, we should also lay special emphasis on looking out for advanced models in agro-ecological protection work and gradually come up with ways of protecting the natural environment.

Seventh, strengthen contingent build-up

Ours is a new contingent of environmental protection [workers]. In general, this contingent has vitality and combat strength. But it also has some problems: its political quality and professional technical quality need to be further improved.

Our leading body has to be built up. In accordance with such requirements as "become revolutionized, rejuvenated, knowledgeable and professional;" leading groups at all levels should selectively recruit outstanding cadres who have good Party spirit, are honest and upright in their ways, have a good grasp of policies, have the courage to uphold principles, and can lead the masses in making breakthroughs. We should step up communist ideological education in our contingent, and build a spiritual civilization. Based on the characteristics of our environmental protection work, emphasize the importance of helping the broad ranks of staff and workers establish in their minds the concept of "serve the people, and be responsible to the people," and help them form a high sense of dedication and responsibility to the revolution, and thus work hard at their posts. Efforts should be put into intellectual power development and personnel training. It is especially important to use all possible means to foster cadres who are currently employed. Our Qinhuang [4440 4106] Island Cadres School provides excellent conditions, and should be managed well. Moreover, all kinds of technical and vocational training classes should be organized everywhere, and vocational training of both administrative and technical cadres should be stressed. We must look for qualified personnel; we must train people and send young cadres who have sound ideological basis and a good capacity for future development to universities and colleges, or research organizations where they can get advanced training opportunities.

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REPORT ON NATIONAL ENVIRONMENTAL PROTECTION CONFERENCE

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983 p 7

[Article: "National Environmental Protection Conference Convenes in Nanjing"]

[Text] From December 9 to 15, 1982, the Ministry of Urban and Rural Construction and Environmental Protection held a National Environmental Protection Conference in Nanjing. Participants at the conference included responsible comrades from environmental protection bureaus (or offices) of various provinces, urban districts and autonomous regions, as well as comrades in charge of environmental protection work from relevant ministries under the State Council and the People's Liberation Army.

Minister Li Ximing [2621 6932 6900] chaired the meeting and delivered an opening speech (summary of speech is published in this issue). Liu Hegeng [0491 0735 6342], Deputy Governor of Jiangsu Province also delivered a speech at the meeting. Introductory reports on typical experiences were presented at the conference by responsible comrades from eleven organizations, including the Municipal Party Committee of Nanjing, the provincial and urban environmental bureaus (offices) of Hunan, Gansu, Beijing, Shanghai, Tianjin, and Jiangsu, the urban environmental protection bureaus of Nanjing and Wuhan, as well as the Safety and Environmental Protection Department of the Ministry of Metallurgy and Hunan Province's Xiangtan Prefecture Office of Environmental Protection. The representatives at the conference conducted an in-depth and extensive discussion on new breakthroughs in environmental protection work with special emphasis on adhering to the spirit of the Twelfth Congress of the Chinese Communist Party and the Fifth Session of the Fifth National People's Congress. Comrade Qu Geping [2575 2706 1627], Director of the Bureau for Urban and Rural Construction Environmental Protection, delivered a speech and summed up the meeting. The representatives agreed in general that the conference was timely and led to serious discussions, and a great deal had been achieved.

In accordance with the magnificent goals set forth at the Twelfth Congress of the Chinese Communist Party for China's economic construction, the conference came up with strategic goals, strategic key points and strategic measures for the environmental protection campaign in our country. The following strategic goals to be achieved by the end of this century for the environmental protection of the whole country were pointed out at the meeting: basically

solve the nation's environmental pollution and ecological breakdown problems; strive to provide a clean and pleasant working and living environment for urban and rural residents; restore all natural ecological environments to a healthy state; and basically meet the living standards for a comfortable material and cultural life of the people. To realize these goals, it is important to regard prevention of industrial pollution and protection of agro-ecological environment as two separate strategic keypoints. During the Sixth Five-Year Plan period, the tenth basic task of the nation's Sixth Five-Year Plan should be completed: "Enhance environmental protection, prevent further environmental pollution, and improve the environmental conditions of some keypoint regions."

Through study and discussion, the representatives at the meeting further consolidated the ideas behind having environmental work serve national economic growth; they also came to understand that it was necessary to adhere to the policy of "combining prevention and control, emphasizing prevention, and tackling problems in a comprehensive way" in environmental protection work. Furthermore, the representatives recognized the importance of having agricultural environment protection become the breakpoint for opening up a new prospect for environmental protection work, and stressing both agricultural environment protection and industrial pollution prevention simultaneously.

In accordance with the suggestions of the representatives, the following major tasks for next year's nationwide environmental protection work were proposed at the meeting: (1) help to materialize the nation's Sixth Five-Year Plan and guarantee the completion of the environmental protection part of the plan; (2) step up the formulation of environmental protection laws and standards for environmental work, and further perfect the environmental protection laws and standard systems; (3) enhance natural environmental protection work with special emphasis on agro-ecological protection; (4) enable the Ministry of Environmental Protection to successfully build up on its own, and strengthen the environmental monitoring posts and environmental science research organizations at all levels; (5) carefully summarize the environmental protection experiences accumulated over the past decade since the first national conference on environmental protection, and formulate strategies for protecting the environment of our country.

At the meeting, the representatives managed to unify their understanding and strengthen their confidence. They unanimously resolved to enhance revolutionary spirit, and strive to open up a new prospect for environmental protection work in our country under the guidance of the spirit of the Twelfth Congress of the Chinese Communist Party.

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POLLUTION PREVENTION IN INDUSTRIAL SYSTEMS DISCUSSED

Environment Minister Comments

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 10, 1982, pp 2-8

[Summing-up speech by Li Ximing, minister of Urban and Rural Construction and Environmental Protection, given at the National Meeting on Pollution Prevention in Industrial Systems, 20 August 1982]

[Text] This is the fifth and the last day of the experience exchange meeting on pollution prevention in China's industrial system jointly sponsored by the State Economic Commission and the Ministry of Urban and Rural Construction and Environmental Protection. It has been a good meeting. Vice Minister Ma Yi [7456 0308] of the State Economic Commission and Vice Minister Fang Weizhong [2075 4850 0022] of the State Planning Commission gave good speeches at the beginning of the meeting and I am in total agreement with them. During the meeting, we have again studied the instructions by Comrade Zhao Ziyang regarding environmental protection at the Anshan Iron and Steel Company, we have exchanged experience on industrial pollution prevention by technological improvement, toured the Beijing Steel Company, discussed and modified two draft resolutions--"Regulations on Industrial Pollution Prevention and Environmental Improvement" and "Targets and Implementations of Pollution Prevention in Major Industries and Enterprises." The audience response has shown that experiences exchanged in this meeting are very persuasive and inspiring; the two draft resolutions are essential and Comrade Ma Yi and Fang Weizhong have expressed the determination of the administration in their speeches. With the concerted effort of the State Planning Commission, the State Economic Commission and the Ministry of Urban and Rural Construction and Environmental Protecting in carrying out the instructions of Comrade Zhao Ziyang, pollution prevention in the nation's industrial system will be moved ahead forcefully. The consensus was that, through this meeting, understanding has been improved, the direction has been clearly defined and the confidence to better the pollution prevention task has been strengthened. All in all, this meeting has been very successful.

I. New prospects after carrying out the instructions of Comrade Zhao Ziyang

On 29 December 1981, Comrade Ziyang made the following statement regarding the environmental protection work at the Anshan Iron and Steel Company: "The

"experience of self-reliance, comprehensive utilization of material and energy resources and treatment of the 'three wastes' at the company is worth our attention. Please make a serious effort to organize and promote this experience; newspapers should publicize the Anshan experience." In the last 6 months, this instruction has been quickly transmitted to all regions and all industrial and transportation departments and measures to carry out this instruction have been drawn up. Special meetings were held in Liaoning, Heilongjiang, Guangdong, Hubei, Sichuan, and Henan to promote the Anshan experience and to sum up local examples of progress. The Ministry of Metallurgical Industry has held discussions on environmental protection at the Anshan Company to study the instructions of Comrade Ziyang and established "Targets on Environmental Protection During the National Economic Readjustment" to show the determination to make greater progress on environmental protection in the metallurgical industry. Many enterprises in China have obtained good results in following the spirit of the instruction and the Anshan experience.

This meeting has fully demonstrated that by thoroughly carrying out Comrade Ziyang's instruction for half a year, our understanding has improved, our effort has made new progress, and there has been new changes in the prospects. All the regions, industrial and transportation departments and enterprises have uniformly paid attention and strengthened the pollution prevention effort. The widespread improvement in understanding is especially valuable. People have clearly realized that the instructions made by Comrade Ziyang have really touched upon the heart of the industrial pollution problem and pointed the way for industrial pollution prevention. Through study and practice, people have recognized the following issues:

A. We must build our environmental protection strategy on the basis of sensible exploitation of resources. In China, industrial pollution is serious, basically, it is caused by the irrational use of material and energy resources, particularly wasteful practices. To control industrial pollution, we must concentrate on this basic issue. We should begin with the improvement of enterprise management, technology, and renovate equipment, turn the "three wastes" into resources, transform these resources into products and cut down the discharge of pollutants as much as possible.

B. Environmental benefits and economic benefits must be combined in preventing industrial pollution. Intrinsically, environmental protection and economic development are consistent with each other, environmental protection may promote economic development. It all depends on whether we are taking the right approach and reconciling the two issues. If we neglect environmental benefits and let industrial pollution run its course, it would invariably affect the progress of the economy. But if we pay attention only to environmental benefits and not to economic benefits, then the environmental protection effort will be separated from the entire national economic development. Only when the two issues are put together will environmental protection work gain vitality and the options will be broadened.

C. Industrial pollution prevention is one part of production activity and must be closely tied to the other parts. The industrial "three wastes" are

generated during the production process, the amount of the "three wastes" discharged can be reduced to the minimum only when pollution prevention is molded into every juncture of production and when the production standard and the extent of reprocessing are improved.

D. The policy of self-sufficiency must be adhered to in preventing industrial pollution. By relying on their own resources, the enterprises must develop potential, mobilize the population and generate funding so that the benefits can be realized while controlling pollution. Naturally, the higher authorities should also provide the enterprises with the necessary support and assistance.

I believe it is a big step that we have recognized the four points above. We should work even harder on this basis to fully carry out Comrade Ziyang's instructions and continue to push forward the effort of preventing industrial pollution.

II. Basic experience in Preventing Industrial Pollution

Fourteen units passed on their pollution prevention experience at this meeting, the Anshan Iron and Steel Company, Beijing Steel, Shenyang Refinery, Hubei Changling Refinery, Nanjing Chemical Plant, Shangdong Zhaoyuan Chemical Plant, Suzhou Huasheng Paper Mill, Hangzhou Railroad Branch Vehicle Section, Neimeng First Machinery Plant, Xian Pharmaceutical Plant, Guangdong Shiqiao Flashlight Plant, Hefei Leather Goods Plant, Shanghai Municipal Light Industry Bureau, and Beijing Municipal Environmental Protection Bureau. Many other enterprises made written presentations and oral presentations in small groups. Although we come from different industries and different situations and have emphasized different methods, we share a number of merits in common. All combined, there are four basic experiences:

A. The basic approach in preventing industrial pollution is to eliminate the "three wastes" as much as possible in the production process through technological improvement.

For most of the enterprises in China the technology is backward, the equipment is obsolete, efficiency is low and consumption of material and energy resources is high. These are the principal reasons for low economic efficiency and are the fundamental causes for serious industrial pollution. The most fundamental task in preventing industrial pollution is therefore technological improvement for all existing enterprises to bring industrial pollution under permanent control. Based on the experiences reported at this meeting, there are five major tasks in controlling pollution through technological improvement: (1) Prevent the large loss of raw material by converting material and energy resources into products to the maximum extent possible and adopt new technologies that are capable of reducing the discharge of pollutants to the largest degree. (2) Substitute obsolete equipment that pollutes the environment and wastes resources and energy with new equipment that is pollution-free, less polluting and conserves material and energy resources. Particularly, we should replace those "coal, electricity and oil guzzlers." (3) with less hazardous

raw material. (4) Modify the illogical product structure and develop new products that do not pollute the environment, such as high strength pesticide with low toxic effects. (5) Inspect the equipment of polluting sources, mobilize the people to improve technology and eliminate or reduce pollution.

Experience has shown that pollution prevention through technological improvement increases the investment benefit and improves the environment. Statistics show that nine enterprises in the metallurgical industry, chemical industry and light industry have undertaken 151 projects and invested 130 million yuan since 1978 to treat the "three wastes" through technological improvement. On average 72 million yuan of profit may be created per year and it takes only 2 years to recover the investment. For some items the investment may be more than recovered in the same year it is invested. Many pollution sources have been brought under permanent control, greatly alleviating environmental pollution.

At the Anshan Iron and Steel Company environmental protection was made an important component of the readjustment policy, it was closely tied with technological improvement to continuously improve the utilization rate of material and energy resources. They have closely integrated control of the "three wastes" comprehensive utilization and technological improvement, they also integrated environmental protection with production development and obtained prominent results in pollution prevention by developing potential in the enterprise itself. From 1978 to 1981, 94 million yuan were invested and 87 environmental protection and technological improvement projects were completed, leading to sound environmental and economic benefits. Dust fallout in the plant zone in 1981 showed a 53.5 percent decrease compared to the 1977 level, the amount of waste water discharged decreased 12.5 percent. They have recovered great quantities of material and energy resources every year, the recovered material was valued at 40 million yuan and the profit exceeded 14 million yuan. The investments made in 4 years will be recovered in a mere 6 years. Today they have established several dozens of production points that make integrated use of the "three wastes" and absorbed 10,000 unemployed youth to participate in this work. Through practice, the Anshan Iron and Steel Company has opened up a new road of self-reliance, comprehensive utilization of resources and treating the "three wastes." The good thing about the Anshan experience is that they have found a solution to two difficult problems: Funds to clean up and transforming the "three wastes" into resources.

For 30 years, the Nanjing Chemical Plant had been using the outdated technology of producing aniline by reducing nitrobezene iron power, the transformation rate was poor, the plant discharged 9,000 tons of sludge containing aniline and 20,000 tons of waste water containing aniline which caused serious pollution and a high frequency of illness among the workers. In 1978, the plant invested 1.8 million yuan and converted the outdated techniques to new techniques of the 1970 standard and doubled their production. The plant made 1 million yuan more profit in one year and recovered the entire modification investment in less than 2 years. In the process, the highly poisonous aniline-containing sludge was totally eliminated, the aniline-containing waste water was reduced by 60 percent and met the state's effluent standards. All the

technological and economic standards have reached international levels and the plant was bestowed the honor of a national gold medal in 1979. This kind of experience is very persuasive.

B. The approach we must take in pollution prevention is to make a major effort in comprehensive utilization of resources and the "three wastes"

Making full use of the "three wastes" is a revenue-generating method for developing potential resources in industry and is an effective means to achieve self-reliance, prevent pollution and improve the environment. There are many ways to achieve comprehensive utilization, many plants, mines and enterprises have taken the following steps: (1) Make full use of the recovered residual heat and combustible gas. (2) By separating clean and contaminated water, using close-loop circulation and using water for multiple purposes, the utilization and circulation of water can be improved and the amount of industrial waste water discharged can be reduced. (3) Recover usable material from the "three wastes" and transform it into new products. (4) If the waste material cannot be used by one plant then we should break down the boundary between plants and let the waste of one plant become the raw material for another plant. Good results have been obtained by following these steps.

In recent years, major industries and enterprises have engaged in multiple use practice and have greatly cut down on the waste of material and energy resources, improved the environment, promoted production development and upgraded economic efficiency. According to data in the metallurgical industry, 2.5 million tons of iron sludge was recovered from sintering, smelting and steel making every year, equivalent to the annual production of a medium-sized iron mine. Each year 12 million tons of iron slag were reused. Cement using blast furnace quench slag as an additive accounted for more than one-half of all the cement produced in China. As much as 53 billion cubic meters of combustible gas were recovered from blast furnaces, coke furnaces and oxygen top ventillation convertors, equivalent to 10 million tons of standard coal. Major nonferrous metallurgical enterprises produced 910,000 tons of sulphuric acid using the waste gas from smelting which amounted to 12 percent of the total material production of sulphuric acid; in addition 50,000 tons per year of nonferrous and precious metals have been recovered from the "three wastes" of the ferrous metal industry. Based on incomplete data, the profit made from "three wastes" utilization was 250 million yuan per year.

Experience has shown that not only large enterprises such as the Anshan Iron and Steel Company have great potential in "three wastes" utilization, medium and small enterprises can also do a great deal in this area. The chemical plant in Zhaoyuan County, Shandong Province, is a small enterprise operated jointly by the county, the commune and the brigade. This plant prospered on "three wastes" utilization. When it was first built, it produced only two products using the refuse of gold mines. During the production process, each pollutant was transformed into a new product and gradually the plant developed a total of 12 products. Because products developed from refuse had low costs, market competition improved. In recent years, this plant invested 720,000 yuan in comprehensive utilization projects and the annual output value from

these projects reached 3.13 million yuan. After paying 917,000 yuan of tax, the profit in one year exceeded the investment made in several years. Today, the total output value of the Zhaoyuan chemical plant has increased from 1.17 million yuan when the plant was first built to 22.74 million yuan and the tax payment has gone from 200,000 yuan to 2.56 million yuan. They have really turned waste into valuable products.

C. It is essential to engage in purification treatment to meet effluent standards

During industrial production, the amount of the "three wastes" discharged may be greatly reduced through technological renovation and comprehensive utilization, but a certain amount of waste will still be discharged. Such pollutants, including smoke, industrial waste gas, and waste water containing poisonous heavy metals, must be treated so that they meet the national pollution standard. The requirements should be even more rigorous for plants located near water reservoirs, densely populated areas, scenic tourist areas and areas with poor self-cleansing ability. Judging from the experience of some units, industrial pollution treatment must take into account both technical feasibility and economic sensibility. Advanced technologies that require small investment and land area and consume less energy should be selected so that greater environmental benefits can be derived from modest economic investment.

D. To prevent industrial pollution we must readjust enterprises, include environmental protection in the enterprise economic responsibility system and strengthen environmental management

Factual data show that any enterprise that has a chaotic business management and production management must also have serious pollution problems. Even if the technology and equipment are up to date, the pollution problem is still serious when the management is not up to par. Survey and analysis of some enterprises have revealed shocking wastes of material and energy resources caused by poor management. That is to say, as soon as we strengthen enterprise management, we can eliminate considerable industrial pollution at no cost or at very low cost.

In the last 2 years, many enterprises have made environmental protection and pollution prevention an important task in enterprise readjustment and an important indicator for evaluating the readjustment. An environmental protection economic responsibility system has been established. The specific measures were: (1) Plant directors were made responsible for the enterprise environmental protection, associated organizations were established, and environmental protection regulations were made more complete; (2) All phases of environmental protection were made part of business and production management, specific environmental protection actions and targets were incorporated into every step of the operation from management planning, quality control, all the way up to economic accounting, and into every unit from shop, section, production post to management department; (3) Based on the principle of combined responsibility, authority and interest, environmental protection targets were evaluated together with production targets, grades and awards were

assigned uniformly, and the economic interests of individual, production post, and shop were linked to the success of environmental management. In the meantime, efforts were made to carry out the "five stresses and the four points of beauty," to promote modern production, to green the plant ground and to build socialist civilization.

During enterprise reorganization, the Beijing Steel Company established an economic responsibility system and greatly improved their economic efficiency, production and profit. In their economic responsibility system, they have transformed the original single purpose pollution control to a full-fledged environmental management that incorporated the dual purpose of improving economic efficiency and improving environmental benefits and molded environmental protection and production into one. They have set 43 environmental protection economic targets regarding material and energy conservation, comprehensive utilization of the "three wastes," water recovery, pollutant discharge control and environmental protection equipment operation and made sure that they were followed by each plant, mine, office, shop, labor group, and each individual worker. They have also conducted rigorous evaluation and equitable rewards so that the formidable task was shouldered by everybody, everyone had specific guidelines to follow, and the vast staff and workers were motivated to prevent pollution and to protect the environment. Beijing Steel has made rapid progress in the last two years in the economic responsibility system, technological readjustment, comprehensive control and environmental protection. The main wastewater discharge outlet has met all the effluent standards set by the state and pollution to surrounding rivers was greatly reduced. Smoke and dust were largely controlled, dust fallout at the plant site was reduced by 2/3 compared to 1978; the utilization rate of industrial sludge has reached 90 percent. Profit realized in the environmental protection and pollutant treatment projects have reached 12.09 million yuan.

The Shenyang Refinery has also had success in environmental management. They established a three-level environmental management system involving the plant, shops and worker groups, drew up environmental protection regulations and six regulations on waste water, and smoke and dust management. These systems were incorporated into the 100 point competition in the economic responsibility system. Based on the degree of difficulty of the tasks, each task was assigned 20 points to 40 points, and the environmental monitoring stations of the plant kept tabs on the environmental tasks around the clock and the units were evaluated, rewarded or premimanded at the end of each month. In the process of strengthening their management, they have chosen management proposals that were low cost, fast and provided both economic and environmental benefits. They have totally changed the prospects in a few short years. By December 1981, they had reduced their discharge of industrial waste water by more than 95 percent, cut their heavy metal release by 94 percent and increased their water circulation utilization rate 80 percent.

In the above we have described the fundamental experience in the current phase of industrial pollution prevention in China, these experiences are generally instructive. We should make good use of these basic experiences and make things better through practice so that the industrial pollution prevention effort in China may continue to achieve new results and make new improvements in the environment.

III. Some comments on the future prevention of industrial pollution

At this meeting many good suggestions were made on how to carry out Comrade Ziyang's instructions further and how to succeed in preventing industrial pollution. I shall now talk about a few of my opinions as a reference for further work of our comrades.

A. Continue to improve the level of awareness of the various leading comrades

Experience exchanged in this meeting has clearly shown that we must first improve the level of awareness before we can succeed in preventing pollution and protecting the environment, and the key is improving the awareness of various leading comrades.

Protecting and improving the environment is a strategic issue in China's economic and social development and it is an important component in the construction of socialist spiritual and material civilization. We must pay attention to the environment whether we are engaged in production or construction. The relationship between developing production and protecting the environment must be properly handled so that we may move forward while taking care of both.

For a long time, there have been two erroneous viewpoints and practices in the world regarding the relationship between environmental protection and economic development. In one view, production should be developed first and pollution treatment comes later. Production is emphasized and ecology is ignored, economic development is sought at the expense of the environment. In the other view, it is believed that economic development should be curtailed or even stopped in order to protect the environment and ecological balance. In both these viewpoints, economic development and environmental protection were separated, attention was focused on the phenomenon instead of the intrinsic nature and both views were therefore metaphysical arguments that only touched upon opposition and did not take cooperation into account. According to the dialectical point of view, materialist environmental protection and economic development are mutually related, mutually promoting and mutually restrictive. What is environment? In short, environment is the total sum of the resources. Environmental protection is to protect and use resources sensibly, to maintain ecological balance, to improve production and the quality of the living environment and to promote a sustained economic development. Economic development, on the other hand, provides the material basis for creating a better environment. Hence, we should develop the economy as well as protect the environment.

Due to our lack of understanding of the environmental problem and due to errors in economic work, the balance between production and construction and environmental protection was seriously disrupted. Today, the level of industrial development in China is not high but environmental pollution is serious. This is a sharp conflict faced by the modernization construction in China. If this conflict is not properly resolved, it will have grave short-term and long-term effects on economic development. Our comrades working on economic development, especially leading comrades of enterprises, must have realized

this problem. When the consumption of material and energy resources is high, economic efficiency must be poor. When industrial pollution is serious, the first victims are the workers of the plant, the attendance rate and production rate will invariably be low. When the surrounding environment is polluted, there will always be frequent pollution related disputes between industry and agriculture and between the plant and the public. In short, the enterprise leaders will not have an easy time as long as the pollution problems remain unsolved. Therefore, pollution prevention is not only the responsibility of the enterprise to society but also is a vital issue affecting the survival and prosperity of the enterprise itself. Today, some enterprises have realized the gravity of the matter and are trying to survive and develop by solving the pollution problem. We hope that this problem will receive the attention of all the regions, industrial and transportation departments, especially leading comrades at various levels. Once the problem is recognized and thought about, then the industrial pollution problem will be gradually resolved with effort.

B. Pollution prevention plans must be carefully established

China is a socialist state that practices planned economy, all enterprises must be conducted under the guidance of the plan. The nature of the environmental problem is very involved and should especially be included in the overall plan. Comrade Fang Weizhong has presented a number of good ideas on this problem at this meeting which should attract the attention of the various planning, economic, industrial and transportation departments. Today, the state has made environmental protection an important strategic target in the economic, social and S&T development plans. In formulating the intermediate and long term national economy and social development plans, major economic activity is considered together with population, labor protection and environmental protection. One chapter in the nation's Sixth 5-Year Plan is devoted to environmental protection and requires the control of industrial pollution. Regions, departments and enterprises must all heed this requirement in formulating their own pollution prevention plans.

Since the conditions for economic development in each region differ, the emphasis and requirements in pollution treatment also differ. In formulating economic, social and S&T plans and projects, each region must take into account its particular situation and determine its goal and measures for environmental protection and include them in the plans and projects for implementation. The 1982 major technological readjustment measures and project plans of Shanghai, Beijing and Tianjin shared one common feature, namely, technological readjustment was linked to environmental protection and municipal public facilities. This approach is desirable because it created conditions for industrial pollution prevention and urban pollution prevention through technological readjustment.

Environmental pollution in China is principally caused by industry. Various departments in industry and transportation must draw up plans to clean up pollution in their own systems. In formulating production development plans, particularly technological transformation plans for their own systems, such departments must make pollution prevention and environmental improvement an

important item in these plans and propose specific targets to be implemented according to schedule in their annual plans. The bicycle industry and knitted goods industry in Tianjin made conserving energy and resources and treating the "three wastes" important parts of their plans and made specific arrangements. This approach is a good one.

All enterprises must take quick action and establish pollution management plans based on the principle of "whoever pollutes is responsible for treating." Today, a number of major industries are in the process of formulating their technological improvement plans. Based on the pollution situation in each individual enterprise, pollution prevention and environmental improvement should be made part of these plans and implemented along with technological transformation. The State Council recently approved the Anshan Iron and Steel Company's "1981-1985 Readjustment and Technological Transformation Plan." In the plan 130 million yuan is stipulated for environmental improvement and pollution reduction, constituting 10 percent of the total project investment. Under this project, product variety will be increased, quality will be improved, consumption will be reduced and the environment will be improved while basically maintaining the current production scale.

C. Improve industrial layout and decrease environmental polluting during industrial readjustment.

Irrational industrial layout is an important reason for the serious pollution in many regions in China. Appropriate readjustment of the current enterprise layout, therefore, will play a positive role in both economic development and pollution reduction. An early decision should be made to close or transform those enterprises that cause serious pollution and cannot be easily improved.

Special attention should be given to the layout of new industrial projects. Economic factors as well as environmental factors such as biological resources, water resources, soil resources and climate and terrain must be considered for all industrial projects. The "Environmental Protection Law" and related State Council decisions must be strictly adhered to during evaluation of environmental impact so that a sensible layout can be achieved. The regulation of the "three simultaneous efforts" must be rigorously followed by all capital construction and technological projects. Pollution prevention measures must be guaranteed along with adequate capital, equipment and material.

In China, industries are highly concentrated in medium and large cities and these cities are continuously growing. This has not only caused urban construction to be more and more behind but also has compounded the urban environmental problem. It must be pointed out that this problem has not been adequately addressed. Many of our serious polluting plants are located upwind of cities, upstream of water resources, densely populated areas, and water resource protection zones. This has put entire cities and river basins under the serious threat of the "three wastes." Under these circumstances, it will be very costly to achieve the goal of controlling pollution and improving the environment. We should remember these lessons well. In the future,

industrial construction projects should be properly arranged according to the nature and the overall planning of the city and the environmental factors. Polluting industries should no longer be developed in major cities such as Beijing, Hangzhou, Suzhou and Guilin where industries are concentrated and environmental quality is poor. Forceful readjustment measures must be taken for presently polluting plants. Industrial layout should be gradually improved to alleviate urban pollution.

Along with the growth of commune and brigade enterprises and the transfer of some urban industries to the countryside, industrial pollution is rapidly spreading to the rural areas. This problem must receive our close attention. The development of commune and brigade enterprises must be combined with the construction of small towns and a centralized plan should be made to properly locate them. The practice by urban plants of transferring the production of toxic and hazardous products to commune and brigade enterprises without pollution prevention facilities must be strictly forbidden.

D. Carry out economic and technological policies that are favorable to both economic development and environmental protection.

It takes policy and science and technology to protect the environment and prevent industrial pollution. On the one hand, the state and relevant departments should consider limiting the development of polluting enterprises, encourage the development of pollution-free and low pollution products and encourage enterprises to prevent pollution when economic and technological policies are made regarding energy resources, water resources, pricing, and credit. On the other hand, environmental protection economic and technological policies should be established and perfected. For the time being, the following policies should be carried out: (1) Encourage industrial enterprises to make use of the "three wastes." The "Environmental Protection Law" states that: "Products produced from waste gas, waste water and sludge as the principle raw material should be given tax reduction, tax exemption and pricing policy considerations, the profits made from such products will not be turned over to the state but will be used by the enterprise for pollution treatment and environmental improvement." The "Regulations On Profit Retention for Industrial and Mining Enterprises Engaged in 'Three Waste' Treatment and Comprehensive Utilization" jointly issued by the Ministry of Finance and the State Council environmental protection leading group, states that profits derived from products produced by the "three wastes" may be exempted from contract payments for the first 5 years and retained for pollution treatment. The regulation also stipulates that tax exemption and reduction applications may be made for such products. In terms of price, the "three wastes" should normally be supplied to other units free of cost for utilization. Costs for reprocessing may be charged for reprocessed products. Once the supply and demand relationship is established, it should not be arbitrarily changed. The implementation of this economic policy was the driving force for the comprehensive utilization of the "three wastes." The problem is that regulation is not well implemented in many regions. An effort must be made to insure that it is thoroughly carried out. An inspection will be conducted in 1982 by environmental protection departments and other concerned departments in the provinces, municipalities and autonomous regions and we will be informed about the inspection results.

(2) Enterprises that discharge pollutants and exceed the standards should be assessed a fine. In February, 1982 the State Council issued the "Provisional Measures for Levying Pollution Charges," which took effect 1 July 1982. Initial results from various regions have shown that this practice has played a useful role in pollution prevention. Environmental protection departments should make good use of the pollution fees. Pollution fees can only be used for environmental protection and cannot be used for other purposes.

(3) Encourage the development of environmental science and technology, especially technologies that reduce pollution and technologies that recover usable material from the "three wastes." Priorities should be given to arranging research projects, funding allocation and the organization of technological manpower. Forces should be organized to attack some of the urgent environmental protection S&T problems. Outstanding S&T achievements should be evaluated periodically and an award system should be established.

E. We must strengthen the leadership in industrial pollution prevention

The success of industrial pollution prevention hinges on strengthening the leadership of this task. The State Council's "Resolution to Enforce Environmental Protection During National Economic Readjustment" pointed out that the "protection of the environment and natural resources are important tasks in the national economy. A fundamental task of the modernization construction is to manage the environment well and to rationally develop and use natural resources." "The People's Government at all levels must regard environmental protection as an important part of their duty." In recent years, the Party Central Committee, the State Council and the People's Government at all levels have been very concerned about environmental protection and have issued a series of directives and resolutions, we must move forward and thoroughly carry out these decisions. Pollution prevention and environmental improvement involve a number of areas in the economy and various departments, the planning commissions and the economic commissions at various levels and the departments in charge of industry and transportation must strengthen the leadership and strike an overall balance between economic development and environmental protection. For example, comprehensive utilization is interdisciplinary and single, uncoordinated efforts are usually unsuccessful. Beijing is doing quite well in this area, the municipal economic commission worked closely with the environmental protection bureau and developed a system to insure the combination of industrial management and environmental management during the readjustment and reorganization of industry and the arrangement of construction projects. Regions, and industrial and transportation departments should be on top of the pollution situation in their area and system and help the plants and mines to solve the pollution prevention problems. Leading comrades of industries, mines and enterprises, especially the first in command, must assume the full responsibility for production development and environmental protection and take charge in the planning and get the jobs done.

Environmental protection departments should work closely with the planning commissions, economic commissions and departments in charge of industry and transportation to organize and promote the development of pollution prevention and arrange the material, equipment and capital required in environmental projects.

They should also work closely with propaganda departments to broadly publicize environmental protection, raise the awareness of leaders and the public, and mobilize the initiative of all branches to protect the environment.

The legal system must be reinforced, all laws and regulations must be obeyed, and offenders must be persecuted. The "Trial Environmental Protection Law of the People's Republic of China" issued by the standing committee of the National People's Congress and the local regulations announced by the standing committee of various provincial, municipal and autonomous regional people's congress and people's governments should be more widely publicized to see to its implementation. The responsibility of offending units must be looked into and handled according to the law. Environmental departments should work with other departments in upholding the law. In the meantime, new regulations should be issued when necessary to supplement the current regulations so that environmental protection laws and regulations may gradually be completed.

The organization question has been addressed extensively at this meeting. Because environmental protection is a new undertaking, the environmental protection departments of local governments have assumed some heavy responsibilities. They should be further strengthened during organizational readjustments. Departments in charge of industry and communication, particularly polluting industries such as the metallurgical industry, chemical industry, light industry, electric power, petroleum, coal, transportation, textile, weaponry, and nuclear industry should strengthen their currently available environmental protection organization.

After this meeting, you should brief the provincial, municipal and autonomous regional people's governments and responsible departments about this meeting. Under the leadership of these departments, Comrade Ziyang's instructions should be more thoroughly carried out in each region and each department so that the development of industrial pollution prevention can be even better.

Fang Weizhong Comments

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 10, 1982, pp 9-12

[Speech by Fang Weizhong [2075 4850 0022] of the State Planning Commission given at the National Meeting on Pollution Prevention in Industrial Systems, 16 August 1982]

[Text] My congratulations to the opening of the national experience-exchange meeting on pollution prevention in industrial systems. We should have more of such meetings because it shows that pollution prevention and environmental protection have become regular items on the agenda and important and concerned activities in economic and social development. It also shows that the guiding ideology of our economic effort has made great progress and our economic construction is moving ahead in a scientific direction.

I. Strategic thinking that must be established in the long-term economic and social developments

We have been working on China's socialist modernization construction for more than 30 years. We have had many successful experiences and also made a number of mistakes. In many areas, we have started with little knowledge and have gradually accumulated knowledge and experience, and have become smarter. In the long-term development plan, people have felt the need to establish the following strategic thinking based on the historical experience in China and in economically developed nations.

A. In economic work, efforts should be centered on improving efficiency; we should not seek to develop by leaps and bounds, instead, we should strive for long-term steady growth.

There seems to be no question about economic work centered on improving efficiency. But an important lesson learned in the past 30 years is that, lured by temporary high growth, we often paid a high price and invested a great deal to achieve fast development but economic efficiency was poor and the standard of living did not improve. This momentary high growth in some cases even brought damage and loss to the people. Therefore, to carry out proper construction in China, we must establish strategic thinking in terms of overall economic efficiency and long-term stability. It is not hard to have momentary high growth but it is a real achievement to obtain long-term steady growth.

B. Before any economic measure is taken, we must consider the large population in China. While strictly controlling our population growth, we should open all production options, develop labor-intensive professions and products and avoid the great rush of the rural population into the cities.

In this regard, it is fair to say that we have made some mistakes but we have also been very effective. The mistake was that we did not strictly control population growth in one period, as a result our current population is over 1 billion. We have been effective because the rural population did not rush to the cities. In 1953, the rural population accounted for 86 percent of the total population; in 1981, the ratio was the same. Even so, large cities still feel the pressure of over concentration due to the natural growth in population and the development of construction projects. We are all aware of the large population in China, but when certain economic and technological measures are to be taken, we often forget to take the population into account.

C. Along with our great effort to develop energy, we should also launch an energy conservation movement and establish a low-consumption, high efficiency economic structure.

China is rich in energy resources, but it takes a great amount of capital and time to develop these resources. Therefore, energy shortage is a long-term problem that we face. The establishment of a low energy consumption (including raw material consumption) and high efficiency economic structure should

become our long-term strategy. We cannot afford uncontrolled consumption of energy resources now nor in the future.

D. Under the pretext of self-reliance, we should learn advanced management experience from foreign countries, make effective use of foreign capital and introduce high technology that suits the domestic stiuation in order to speed up our economic development.

We should be self-sufficient but we cannot follow a closed-door policy. An important strategy is to develop our own strengths, learn from other countries and develop international economic exchange. We cannot progress if we close our doors.

E. We must pay attention to environmental protection and ecological balance in the development of industrial and agricultural production and think about future generations.

On this matter, our awareness was too slow. As some comrades have pointed out, industrial development in China is not yet advanced but environmental pollution is very serious. This has become a sharp contradiction in China's modernization process. We are now paying a price for concentrating only on production and construction and ignoring pollution prevention and environmental protection. We are now beginning to understand the relationship among the economy, technology and society. Mutual dependence and mutual constraint exist among population, resource and the environment. Development must, therefore, follow a coordinated approach in order to be healthy and long-lasting. This strategic thought must be firmly established.

F. The construction of material and spiritual civilization should proceed simultaneously. Economic policies should not only consider the improvement of people's material life but also help to cultivate and develop collectivism, patriotism, communism, and the unification of the nation and the country.

The significance of this point is well-known. If attention is focused only on material civilization and material interest and not on the construction of spiritual civilization and the thought of serving the people, then we will go astray.

In short, we must strive to achieve a "constructive cycle" in economic and social development and avoid the pitfalls and public hazards that appear in economically developed nations. If we do not establish these strategic ideologies, we would be shortsignted and looking for trouble. To put it another way, we have suffered quite a bit in the past and we should try to stay away from trouble in the future.

These strategic ideologies are closely related to pollution prevention and environmental improvement. Through these ideologies, we realize the profound significance of protecting the environment and maintaining the ecological balance and seek the reasons for the serious pollution and damage to our environment today and effective measures for solving such problems.

The past negligence of the environment is closely related to the lack of an overall idea about economic efficiency and the desire for temporary high rate of growth. Because we ignored pollution prevention and ecological balance in production and made no investments for pollution prevention in construction projects in the past, we are now forced to remedy the situation and are spending a lot more money.

Because we have such a large population, we had to broaden our production activity for employment reasons. Due to the lack of environmental awareness, we paid attention only to employment and making money and neglected the environment. This is an important reason for industrial pollution. If we do not pay attention to industrial pollution and let pollution spread from the city to the countryside, it would not only make pollution more and more difficult to treat but also hinder our effort to broaden production activity.

The unscientific use of energy resource is also closely tied with environmental pollution. Whenever an enterprise is poorly managed, it not only wastes great quantities of energy but also produces serious pollution. Comprehensive utilization of energy not only helps to establish a low energy consumption economic structure but also helps to protect the environment, prevent pollution and unify the economic benefits and environmental benefits.

The material civilization we are building should not only provide sufficient material for our daily life but also provide good surroundings and natural environment. It will take us several decades to create a pleasant environment. We cannot build a society of hazardous air and disease. To build a good environment takes money and, more importantly, it takes a healthy attitude of serving the people and being responsible to the people. Mere concern with one's own financial situation and ignoring the welfare of the people will not lead to a good and clean environment and is diametrically opposed to the goal of our socialist production development. The cause of today's serious industrial pollution, beside the objective difficulties which indeed exist, is mainly the lack of an attitude to serve the people, to be responsible to the people and to think about future generations. In fact, some of our industrial polluters are also the victims of pollution; preventing pollution is the social responsibility of our socialist enterprises. As long as people's welfare is given the proper consideration, the determination to treat pollution will be great and the action will be fast. In this respect, it is also an important issue in the construction of the spiritual civilization.

The strategic ideologies discussed above were obtained at a price and should be well heeded in our construction endeavor.

II. Environmental protection programs in the "Sixth 5-Year Plan"

We are in the process of formulating the "Sixth 5-Year Plan" in our national economic and social development. Prevention of pollution and protection of the environment should be made important parts of the "Sixth 5-Year Plan." The policy of readjustment, restructuring, reorganization and upgrading--will

continue to be implemented in the "Sixth 5-Year Plan" to create favorable conditions for pollution prevention.

When we speak of readjustment, it includes readjustment of the industrial layout and the organizational structure. Seriously polluting industries should be reorganized and transferred; if treatment cannot be done right away, they should be closed down or modified to produce different products. When we speak of reorganization, it should include cleaning up the environment and treating pollution. Reorganization is not completed until the pollution situation is changed. During the course of the "Sixth 5-Year Plan" systematic technological transformation is itself a means for pollution prevention and comprehensive utilization. Pollution prevention should be an important component in technological transformation.

During the period of the "Sixth 5-Year Plan," we cannot expect too much from environmental protection, but we should insist that further deterioration of the environment be halted and new pollution prevented. In the meantime, treatment should be carried out for units and regions with serious pollution problems to improve the local environment. These are minimum demands, if we cannot even achieve the minimum, then we will have nothing to show the people. To realize this minimum goal, we must meet the following specific requirements:

A. Newly constructed enterprises must strictly carryout the "three simultaneous efforts." Pollution prevention measures and projects must be designed, built and put into use simultaneously with the main engineering project in order to prevent the creation of new pollution sources. This is an important step in controlling the deterioration of the environment.

B. Regions and departments must treat the pollution of old enterprises in stages, improve the ability to treat the "three wastes" and the level of comprehensive utilization. In the "Sixth 5-Year Plan," the requirement for industrial waste water treatment will be increased from 7-8 percent in 1980 to 25 percent in 1985. Treatment of hazardous gas will be increased from 8-9 percent in 1980 to 25 percent in 1985, and the utilization rate of industrial sludge will be increased from 20 percent in 1980 to 40 percent in 1985. Before 1985, waste water from plants and mines containing heavy metals such as mercury, chromium and cadmium must be treated in the plant and cannot be dumped into lakes, rivers or the ocean. Some of the heavy polluters such as the metallurgical industry, chemical industry, petroleum industry, building material, light industry, textile and electric power industry must be asked to use resources and energy sensibly and to meet the local standards on the "three wastes" discharge and plant site noise level.

C. Measures must be taken to control the water quality of the Chang Jiang (15 sections), Huang He (Luoyang section), Songhua Jiang, Huai He, Bo Hai and the Huang Hai to prevent further deterioration. Protect the water quality of major city reservoirs and the water quality of the Li Jiang, Dianchi, Xi Hu and Tai Hu.

D. Significantly improve the appearance of Beijing in 3 to 5 years and gradually restore the scenery in Suzhou, Hangzhou, Guilin and other tourist cities. Reduce the waste water discharge, dust fallout, sulphur dioxide and noise to levels acceptable to the environmental protection standard. Reduce air pollution and solve the industrial noise problem. Provinces, municipalities, and autonomous regions should concentrate on the pollution problems of one or two cities in their region and improve the environment.

E. Work on regional planning and management of the natural environment.

The targets and requirements stated above should be included in the "Sixth 5-Year Plan" after they are studied and finalized by the responsible departments. Are there funding guarantees for these targets and requirements; where will the funds come from?

(1) New construction projects and projects to modify and expand old plants must include the needed funds for treating pollution in the capital construction investment plan. This money should be spent. When the state reviews and approves investments for capital construction projects, investments for pollution prevention and environmental improvement are included. When there is a shortage of capital, the scale of the construction should be cut back and the number of projects may even be reduced. Funds for pollution prevention and for the main engineering project in new constructions, modifications and expansions must be arranged simultaneously. This investment should be guaranteed.

(2) Old enterprises should make good use of renovation and restructuring funds to treat pollution. Today, many enterprises use the modification fund mainly for increasing their production ability and expanding their reproduction, this is a mistake. According to rough estimates, there will be an average of 25 billion yuan of modification funds per year during the "Sixth 5-Year Plan" period, this is a big sum of money. Statistics show that 50 to 70 percent were used on capital construction and only 20 percent or so were actually used for renewal and improvement, but even then the modifications were mostly old technology and rarely new technology. Therefore, a large portion of the present improvement and restructuring fund was used improperly. Some enterprises, on the one hand, claimed that they did not have the money to renew their equipment, improve technology and deal with pollution problems but on the other hand they spent a lot of money on capital construction and aggravated the pollution problem. This type of problem must be resolved. In the future, the improvement fund must be used for energy conservation, raw material conservation, product quality and performance improvement, product changeover and pollution treatment. Once the improvement funds are used in the right direction, there will be a reliable source of money for pollution prevention.

(3) Major cities may use 5 percent of their industrial and commercial profit for urban maintenance, including general pollution prevention projects.

(4) Assess a pollution fee. The State Council has already approved the assessment of pollution fees in China and results have been obtained from those

regions that tried it. Serious polluters should even be fined. These monies should be collected from polluters and used for solving pollution problems. Enterprises that cause severe pollution and damage and that are difficult to treat or the investment for treating pollution is too large to be economical, should definitely be closed down and the workers should be transferred elsewhere.

(5) General use of the profit retention fund. Regulations have been clearly spelled out in the "Measures on Profit Retention for Industrial and Mining Enterprises Engaged in 'Three Waste" Treatment and Comprehensive Utilization" issued by the Ministry of Finance and the State Council environmental protection leading group. Finance departments and industry and transportation departments should implement these regulations thoroughly.

(6) It takes money to establish environmental protection units such as instituting environmental research and monitoring systems. This money should be budgeted by the state and by the provinces, municipalities and autonomous regions and each year a special allocation should be made from the finance plan.

III. The key is in the doing

After years of work, people have gradually increased their understanding of environmental protection. Environmental protection organizations have been established by the Party Central Committee, the provinces, municipalities, autonomous regions, various departments and some enterprises, a great amount of work has been done with considerable success. The standing committee of the National People's Congress issued the "Environmental Protection Law" and the State Council also promulgated some specific regulations. It is fair to say that we have done some legislative and propaganda work and we should continue to work in these areas. But merely urging is not enough and the key to success is in the doing. This is an important issue.

A. Regulations should be uniformly established. Beginning in 1983, we will be formulating a 20-year plan for the remainder of this century. This plan shall include specific projects such as S&T development plans, agricultural development plans, energy and transportation development plans, and environmental protection plans. To do a good job on environment protection in China, we must first have a long-term plan and long-term considerations then divide the task into periods and clearly define the jobs in each period. The long-term plans of each department, region and enterprises must contain pollution prevention and environmental protection. Without a workable plan, there will be nothing to guide our activities. Without environmental protection, a plan is not complete. The first order of business, therefore, is to establish an environmental protection plan. We cannot proceed blindly or aimlessly, we must move forward according to a plan and make step by step progress. Only then can we continue to move ahead effectively.

B. We should establish a series of laws and regulations. Laws and regulations are essential, because without them there would not be a standard.

There must be a requirement and a specification for any activity. Naturally, the regulation must be practical, it should neither be slack and perfunctory, nor should it be impractical and unachieveable. We already have an environmental protection law but we still need to establish a series of regulations for atmospheric pollution prevention, water pollution prevention, marine environmental protection and noise control regulations. We should establish a system of regulations and standards as our basis. Today the Ministry of Urban and Rural Construction and Environmental Protection is actively working in this area. This is very good and very important.

C. Rules and regulations must be strictly enforced. In order to ensure compliance we need strong monitoring and management organizations and we need people to run them. If we do not enforce the regulations, there is no difference between having and not having a law.

Some comrades claim that some leaders and administrators are not enforcing the law, not the people. Since the laws are made by the standing committee of the people's congress and the State Council, everybody should follow them, leaders should direct others to do so. If the laws and regulations are not enforceable by the leadership, then they are meaningless.

We often hear leadership comrades at some regions and units say that they have serious pollution problems that cannot be controlled. Someone should investigate whether they have tried to control it and whether serious efforts have been made to manage it. A lot of good experience has been presented at this meeting. The comrades at the Anshan Company and Beijing Steel, for example, did not just pay lip service, they actually did something and succeeded in pollution management and in carrying out the "Environmental Protection Law." Whether the pollution problem is in a region, a department or an enterprise, if the people themselves do not take the initiative and remain passive, it will be very difficult to change the situation. It takes self-awareness and push to change the situation, and this is why we have regulations. The principle of "Whoever pollutes is responsible for control" is truly fair. Regions and departments should actively support the environmental departments in doing their job and should accept monitoring and inspection. The cause of environmental protection is for the benefit of the people and future generations.

It should be said here that there are two things which must be done. First, we must establish a "plant law" to clearly spell out what kind of plant can or cannot be built. Second, new projects must carry out the "three simultaneous efforts," a regulation passed by the State Council. Today, some enterprises are not carrying out the regulation seriously; although pollution treatment is budgeted in the project, it is often not carried out, using the excuse that they are trying to enter production as early as possible. Industrial departments and environmental protection departments should step up the monitoring and inspection of projects that do not implement the "three simultaneous efforts." The environmental department should not approve projects that do not implement the "three simultaneous efforts" and without the approval of the environmental department the project cannot begin construction. If it is already built, it cannot begin production without the

approval of the environmental department. Today, pollution is serious. If we do not take strong measures, it will be very difficult to change the present situation.

D. We must increase research on environmental protection. We have now settled on one thing: before growth plans are formulated, science and technology programs must be formulated. Departments and enterprises must first have a plan that determines what technological policies are to be followed and what technical approach will be taken. Because we neglected this area in the past, we created many problems. We must strengthen this area in the future. China has now established an institute of environmental science and various provinces, municipalities and autonomous regions have also established environmental protection offices. We should strengthen these organizations and the money needed to do so should be allocated.

Another important point is not to diffuse the scientific and technological forces; the forces should be brought together. The problem we face now is not a shortage of manpower, the problem is that personnel are not well organized and mobilized. On the one hand, we have urgent scientific projects to pursue, and on the other hand many people are idle and research efforts are repetitious. This is a major flaw.

Naturally, our planning departments have a lot of work to do. First, we must do a good job on the 20-year planning, including the regional plans. In addition, we need to work on land restoration, development plans, and agricultural regional plans. Much industrial pollution is caused by irrational layout, strengthening regional planning is a fundamental measure in environmental protection. Once we have the regional plans, we then need to work on plans for each industry, and each plan must contain environmental protection. We at the planning department must learn from everybody, study good experience and useful ideas, and promote the development of pollution prevention and environmental protection from the planning angle.

9698
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CONFERENCE ON PREVENTION AND CONTROL OF INDUSTRIAL POLLUTION HELD

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 11, 1982, p 27

[Article by correspondent Yang Suzhen [2799 4790 6297]: "Beijing Convenes Conference on Prevention and Control of Industrial Pollution"]

[Text] The Beijing Municipal Economic Committee and the Beijing Municipal Environmental Protection Bureau held a conference on the prevention and control of industrial pollution in Beijing from 11 to 13 September. Responsible people from each prefecture, county, municipal bureau of industry, major industrial companies, key factories, and key factories of the various ministries of the State Council in Beijing participated; leading comrades of the City Government Administration Office, the City Planning Committee, the Planning Bureau, the Finance Bureau and other related departments were invited. A total of 340 people attended the meeting.

Deputy director of the Beijing Municipal Environmental Protection Bureau, Comrade Gao Yusheng [7559 1342 5116], conveyed to the conference on exchanging experience in the prevention and control of pollution in the national industrial sector, the importance of implementing the directive of Premier Zhao Ziyang concerning the experience of environmental protection work at the Anshan Iron and Steel Company. The deputy director of the city's economic committee, Comrade Wei Wenlie [7614 2429 3525], reported on the "Major goals and Measures to Prevent and Control Industrial Pollution in Beijing City during the "Sixth 5-Year Plan" and the plan for 1983." Deputy mayor Lu Yu [7120 4416] gave an important talk at the closing ceremony, he affirmed that over the past several years, the work of preventing and controlling pollution by the industrial sector has progressed greatly. The question of how to strengthen prevention and control of industrial pollution was discussed in five aspects: (1) We must improve understanding. (2) We must require each unit to conscientiously study advanced domestic and foreign experience, and hasten the progress in the prevention and control of industrial pollution. (3) We must solve the problems of industrial pollution mainly through self-reliance, and develop the potential of the enterprises. (4) We must strictly implement the laws and regulations on environmental protection, and use legal means to stimulate the work of preventing and controlling pollution by enterprises. (5) We must establish short-term and long-term plans to prevent and control industrial pollution on the basis of the requirements for Beijing issued by the Party Central Committee.

During the meeting, delegates emphasized discussion on the revision of the "Major Goals and Measures To Prevent and Control Industrial Pollution in Beijing City during the "Sixth 5-Year Plan" and the "Plan for 1983." Everyone is determined to build the capital into a first rate city that has the cleanest, the most sanitary and the most beautiful environment in the nation.

9296
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NATURE, TASKS OF ENVIRONMENTAL ECONOMICS SURVEYED

Kunming YUNNAN SHEHUI KEXUE [SOCIAL SCIENCES IN YUNNAN] in Chinese No 6, 1982 pp 38-47, 37

[Article by Chen Dongsheng [7115 2767 3932]: "A Preliminary Discussion of Environmental Economics"]

[Excerpts] In the 1960's the environmental crisis engulfed all of the industrially developed countries, and cries of "Give us back our clean skies" and "Give us back our clean water and green land" resounded throughout Europe, America and Japan. In order to escape the environment's punishment of humanity, many economists and natural scientists in these countries involved themselves in the study of pollution prevention programs and investigation of the relationship between economic development and the environment, which eventually resulted in the creation and development of environmental economics.

Environmental economics was long a nonexistent field in our country; it was only in 1978 that it began to receive serious attention from theoretical workers and practical departments. In this paper we undertake a preliminary discussion of the theoretical and practical problems of environmental economics and ways of establishing and developing it in our country as these matters relate directly to the readjustment of the national economy and to overall policies for future economic construction.

I. Objects of Study and Significance of Environmental Economics

Economics is the science which studies and identifies the objective laws governing the entire economic reproduction process, including production, circulation, distribution and consumption. The economic reproduction process does not take place in a self-contained system, but is intimately related to the natural environment surrounding man, including the biosphere, the atmosphere, the pedosphere and the lithosphere. Marx and Engels constantly emphasized that "Labor is not the only source of the utility value, i.e. material wealth, which it produces," and that "It is labor and the natural world taken together which are the source of all wealth, for the natural world furnishes materials for labor, while labor converts the materials into wealth."[2] They also clearly pointed out that "Labor is first of all a process between man and nature by which man's own activity initiates, adjusts and controls the exchange of matter between man and nature," and thus that

there is a complex material cycle and energy conversion taking place between economic reproduction process and the environment. The main channels involved are: (1) conversion of solar energy and organic matter such as water and carbon dioxide into food and raw materials by means of plant photosynthesis in the agricultural departments, and their introduction into the economic system; (2) introduction of fossil fuels (such as coal, oil, oil shales and the like) and mineral resources into the economic system by the extractive industries; (3) discharge of various production and living wastes into the environment by the economic system. Thus in overall terms the economic system is a social-economic-ecological system. As Marx stated, in agriculture "No matter what its particular social nature, the economic reproduction system in this sector (agriculture) always is interwoven with a natural reproduction process."[4] In the broad sense, this interwoven condition includes all departments of the national economy. The environment and the ecological system are both the providers of one-time resources and energy for economic reproduction and the carriers of all wastes from the economic reproduction process. The complex "input" and "output" relationships between the two dictate that for smooth functioning of the economic reproduction process, it must respect all objective economic laws and all natural ecological laws. This is the objective basis for the need for economic study of the environment.

What is environmental economics? In general terms, it is a science which makes combined use of the theories and methods of economics and environmental sciences, which investigates the relationship between economic development and the environment, and which seeks coordination and permanent balance between economic development and the environment. Accordingly the intersection of the economic reproduction process, the environment and the ecological system is the focal point of environmental economic research, and the topics which it must concentrate on solving are the following: studying the environmental and ecological effects of economic activity, converting these effects into economic feedback for balancing and accounting in the national economy, and providing the theoretical and methodological bases for correctly setting social and economic development strategies and particular economic policies and for selecting realistic, practical programs to solve environmental problems.

Marx predicted that: "Socialized man and the united producers will rationally regulate their exchange of matter with nature, place it under their joint control, and prevent it from becoming a blind force controlling them; they will carry on this material exchange by means of the most efficient forces and under the conditions which are best suited to their humanity."[5] This is the basic task of socialist environmental economics. In other words, environmental economics must seek a balance between economic development and the environment in order to promote the health of the present generation and create benefits for future generations, and in order to furnish the natural material basis for both the development of current production and the long-term protection and development of the economy.

In Marxist economic theory, the study of the relationship between economic development and the environment is not new. Marx, in "Das Kapital," and Engels,

in "The Condition of the English Working Class," "Anti-Duhring" and "The Dialectics of Nature," gave penetrating discussions of the fact that the natural environment is the most basic condition for social material production and life, that man and environment are in the position of a union of opposites, and that violating natural laws will sooner or later call down retribution from nature; in addition they demonstrated the relationship between the social system and environmental protection, and between minimizing production waste and making thorough use of resources. But environmental science has emerged as a separate branch of science only in the last 10-odd years. It has developed the fields of pollution economics and environmental harm economics in connection with the economic problems of dealing with industrial pollution, and has focused on the economic losses produced by pollution, the cost-benefit analysis of pollution control, and selection of methods and programs for pollution control. In addition, it has pursued research in resource economics and ecological economics in connection with the scarcity and coming exhaustion of mineral deposits and other nonrenewable resources and the problems of protecting and propagating biological and other renewable resources. On this basis, a science of environmental economics which comprehensively studies the interaction of human economic activity and the environment has gradually taken shape.

Environmental economics studies the interaction of social economy and natural ecology as a whole; as a result it is an interdisciplinary field in which social science and natural science interact and permeate each other. This characteristic of environmental economics requires that its practitioners must be thoroughly familiar with economics and natural science if they are to systematize the various natural-science phenomena occurring in the interaction between nature and social economics from an economic viewpoint and give them new order and significance.

Is environmental economics applied science or basic science? In terms of the present state of research, it is primarily an applied science. Currently it makes primary use of economic theories and methods to study and analyze economic problems in the special field of environmental protection. For example, it uses the theory of political economy to analyze various basic theories of environmental economics; it uses the economic theory of productive potential to analyze the relationship between efficient organization of productive capacities and environmental protection; it uses the theory and analytical methods of economic effectiveness to analyze the economic benefits of environmental protection; and it uses the theory and methods of management science to investigate the system and methods of environmental management.

For the long term, some foreign scientists believe that as research into the social-economic-ecological system becomes more profound, it may produce many changes in many traditional economic theories, and that environmental economics will then become true economics in the broad sense, thus becoming a basic science.

III. Analysis of China's Environmental Pollution and Its Causes

Environmental protection work began rather late in this country. Following the first national environmental protection conference in 1973, and particularly

following the Central Committee's circulation of the State Council Environmental Protection Leadership Group's document "Main Points of the Report on Environmental Protection" shortly after the conclusion of the Third Plenary Session of the 11th Central Committee in 1978, the various aspects of environmental protection work made major progress nationwide. But overall, environmental pollution and damage to natural resources have not yet been brought under control, but have actually expanded. In 1979 our country discharged a total of 78.8 million tons of industrial and domestic wastewater, 9.9 billion cubic meters of waste gases and 450 million tons of waste every day. On the basis of comparable data from 14 provinces, municipalities and autonomous regions, the 1979 wastewater discharge figure was 8 percent higher than in 1978 and 22 percent higher than in 1977; waste gas discharges in 1979 were 5.6 percent higher than in 1978 and 18 percent higher than in 1977; and solid waste disposal in 1979 was 3.6 percent higher than in 1978 and 12 percent higher than in 1977. What was the reason? Below we give a preliminary analysis in terms of environmental economics.

A. Low Utilization Ratio for Resources and Energy and Poor Comprehensive Utilization

The amount of waste from the production process is inversely proportional to the effective utilization rate of raw and other materials and fuels. Our country's industry is currently on a much smaller scale than that of Japan, but discharges of many wastes are several times the corresponding levels in Japan; total discharges of smoke and ash are three times higher and those of sulfur dioxide two times higher. The basic reason for this situation is low utilization ratios for resources and energy and a shocking waste of raw materials. The energy utilization ratio is 57 percent in Japan, 50 percent in the United States, about 40 percent in the various Western Europe countries, and an average of only 30 percent in this country. This factor alone is equivalent to converting well over 100 million tons of fuel into wastes and discharging them into the environment every year. Our energy consumption per hundred million U.S. dollars is not only higher than that in any of the industrially developed countries, but is also higher than such developing countries as Indonesia and India. Currently 40 percent of enterprises have energy utilization efficiencies lower than their best past levels. In the case of wood, the national average utilization ratio is 50 percent, while the value for the paper industry is 45 percent; compared with the advanced Jilin Paper Mill, this is equivalent to converting more than 20,000 cubic meters of wood into more than 7,000 tons of waste fiber and discharging it into rivers every year. The quantity of water used per unit industrial output is even worse when compared with foreign figures. Abroad, about 100 tons of water is used per ton of steel produced, while our country requires 200 or 300 tons; the amount of fresh makeup water is 3 to 5 tons abroad and an average of 60 tons in this country; the amount of water required in the production of a ton of newsprint is about 50 tons abroad and 100 to 300 tons in this country; 0.2 tons of water is used to refine 1 ton of petroleum abroad, while from 5-6 tons to as much as 30-plus tons is used in this country, i.e. from several times as much to several tens of times as much. If water use is high, water discharges also increase, and thus our total industrial wastewater discharges also are higher than in Japan.

The low level of comprehensive utilization means that many resources which should be recovered and recycled become pollutants. For example, blast furnace slag is an excellent material for cement-making, which is completely utilized in the United States, while in this country 40 percent of it, equivalent to 8.6 million tons a year, is disposed of and becomes a nuisance. The blast furnace slag from some iron and steel works contains valuable scarce rare earth elements, most of which currently become pollutants and waste. The sulfur dioxide final exhaust gas produced in the refining of nonferrous metals is an excellent starting material for the production of sulfuric acid, but currently, high-concentration SO_2-containing final exhaust gases equivalent to 500,000 to 600,000 tons of sulfuric acid are discharged every year. Each year 200,000 tons of petroleum refinery gas is burned in flares nationwide. Every year the paper industry discharges caustic soda equivalent to a third of the nationwide annual output into rivers. If all of the dust emitted by cement works were recovered, nationwide cement output could be increased by 10 percent. But the utilization ratios and levels of comprehensive utilization of raw materials and energy are low because many enterprises are using obsolete production technologies and outmoded equipment, much of which is not in good working order, emissions and leakage are serious problems, management standards are low, and production capacities are not scientifically organized.

B. Failure to Completely Integrate Environmental Protection Into Planned Management of the National Economy

Socialism is a planned economy, and only by comprehensively including environmental protection in the management of the national economy and considering its requirements in connection with development and utilization of resources, production-related construction programs, production lines, selection of technological policies (such as limiting or prohibiting harmful raw materials, processes and products and expanding the use of harmless raw materials, processes and products), geographical distribution of industry and economic distribution, and only by treating environmental balancing (including the balancing of resources with resource reproduction, proliferation and supply) as a major aspect of the overall balancing of the national economy and treating environmental protection performance as an important aspect of national economic evaluation, is it possible to prevent pollution by means of an economic development strategy. A series of problems await solution in these areas, involving both ideological understanding and specific action.

C. Incomplete Solution of the Problems of Including Environmental Protection in State Evaluation of Enterprise Management Performance

Plants are the main sources of waste discharges, but the eight economic and technical indicators used for enterprise evaluation make no reference to environmental pollution, and no matter how serious the pollution which a plant causes, this does not affect the enterprise funds which it receives. This state of affairs inevitably causes production to be divorced from environmental protection or even to be in opposition to it, creating a situation in which it makes no difference how many pollutants are discharged and whether or not they are treated; it even happens that an enterprise will suffer loss

if it treats pollutants rather than leaving them untreated, because it will have to increase personnel and equipment and will have higher production costs, while wanton discharge of pollutants entails no sanctions. Another result is that existing pollution treatment equipment stands idle or falls into disrepair and is scrapped. In the cotton printing industry, for example, of well over a hundred plants nationwide, only 30 percent have wastewater treatment facilities, while these facilities are in normal operation in only 30 percent of the plants which have them, so that less than 10 percent of all plants treat wastewater before discharging it. Most of the enterprises have not yet established internal environmental protection rules and regulations or responsibility systems. The problem of closely linking quantities of emissions with economic responsibility and the economic interests of enterprise leadership and employees has not yet been resolved.

D. Defects in the Economic Management System Have Seriously Harmed the Development of Waste Control and Comprehensive Utilization

With state centralized control over receipts and outlays, the enterprises lack relative independence and autonomy and the plants have the burden of dealing with the "three wastes" while they lack the requisite powers in terms of personnel, finance and materials. There are many cases of higher-level bureaucrats sending down orders to "control pollution by a certain date," but few of these bureaucrats undertake to arrange for funds, equipment, materials and construction capacities. Some plants have taken the initiative in sending waste control plants to the higher levels; but when it came time to ask for money or materials, the various bureaus involved passed the buck for years, and when the situation eventually had become harmful it still had not been made clear who was to assume responsibility. Responsibilities and powers were separated, no strict responsibility system was set up, and many environmental rules and regulations were not implemented by specific units or individuals, so that they remained nothing but meaningless pieces of paper. Centralized state control of receipts and outlays created a situation in which many enterprises could be reimbursed hundreds of thousands of yuan for their pollution fees year after year, while there was no source of funds for pollution control; the masses criticized this state of affairs as "having the money to buy a coffin but no money to treat the disease." Use of administrative measures through administrative chains of command to manage the enterprises disrupted horizontal resource utilization relationships; every department sent down assignments for output of the main products to the enterprises and distributed investments, equipment and materials, and the enterprises concerned themselves only with meeting the plan indicators for the main products, while they were subject to no requirements with regard to comprehensive utilization of resources and the lacked material conditions. As a result, implementing multi-industry comprehensive utilization became a difficult, persistent problem.

With these problems in environmental management, the enterprises lacked both internal incentive, stemming from their own economic interests, to concern themselves with waste control, and external pressure, stemming from the economic responsibility system, to concern themselves with environmental protection, so that even if they wished to work on waste control, they did not have the personnel, financial and material powers to do so. This is the crux of

the problem of uncontrolled expansion of pollution by the "three wastes." Research in economic theory aimed at providing a theoretical basis for a practical solution to these problems is an important task of environmental economics.

IV. Main Types of Research in Environmental Economics

If we consider environmental economics research in terms of the basic principles of Marxism and in its relation to the practical problems of our country's environmental protection work, we find that it falls into the following four main areas.

A. Basic Theoretical Research in Environmental Economics

This work deals with the relationship between the social system and environmental protection, the relationship between economic development and environmental protection, the value approach to environmental resources, and the like.

Engels pointed out that "All forms of production that have existed so far involve taking the most immediate, most direct results of labor," that "When a capitalist engages in production or exchange in pursuit of direct profit, he must start by considering the most immediate and direct results," and that "What people then consider surprising is that the longer-range effects of behavior aimed at these results is quite a different matter and in most cases is in fact entirely the opposite."[6] In the pursuit of maximum profits, development of production inevitably comes into sharp conflict with protection of the environment; this circumstance cannot be fundamentally eradicated in the capitalist system. But after the serious blow of the environmental crisis in the 1960's, many industrially developed countries resorted to government intervention through environmental legislation and environmental programs to carry out stringent environmental management and renovation, resulting in a considerable improvement in the pollution situation. On the one hand, these circumstances require a correct theoretical explanation, while on the other, effective environmental management experience usable in this country should be conscientiously studied and absorbed. Engels also predicted: "Only a society which can organize its own productive forces in coordinated fashion in accordance with an overall plan will be able to allow industry to be distributed through the country in a way suited to its own development and in accord with the principles of preservation and development of other productive factors."[7] Many years' practical experience in this country makes it clear that it is by no means an easy matter to thoroughly bring into play the superiority of the socialist system in environmental protection. Conscientiously summarizing the lessons of experience in this area, investigating them over the full scale from rational organization of productive capacities to forms of the economic management system and techniques for its operation, and studying how to bring the advantage of the socialist system in this area into play, pose extensive topics of study for environmental economics. Some examples are the questions of how to include environmental resources in the overall state economic balance, how to take account of both present and long-term interests, how to correctly set the optimal proportionalities for the

scale and speed of development of the main industrial and agricultural production departments on the one hand and the pollution-elimination departments on the other. Another topic is the value approach to environmental resources. When the scale of development of productive capacities was limited and production waste could be purified naturally without presenting any danger, people were unable to devote labor and money to discharge treatment, pure water and air were treated as things of no value which were furnished inexhaustible by nature, and were not included among commodity production expenses or taken into account in value calculations. Today, when the scale of development of productive capacities has increased drastically, when population is growing rapidly, when economic density is steadily rising, and when, particularly in cities with concentrated industry, total amounts of production and living wastes exceed the capacity of the environment, in order to protect environmental quality it is necessary to invest large amounts of labor in treating discharges; and if these types of labor expenditures are still excluded from "socially necessary labor time" and uncompensated use of environmental resources continues, then every enterprise and person will still consider only the most immediate and direct results in organizing production and selecting production-related construction programs and will take no account of social effects, still continuing to treat nature as a trash can into which it can discard wastes at will and without cost. Making the correct response to this situation in terms of economic theory is a basic problem which involves rational organization of social productive capacities and the question of how to use economic measures for environmental management.

B. Study of the Relationship Between Rational Organization of Productive Capacities and Environmental Protection

Ultimately, environmental pollution and damage result from irrational development and utilization of natural resources, and accordingly rational development of resources and rational organization of productive capacities are the most fundamental environmental protection measures. The tortuous paths which the industrially developed countries have taken in the last 10-odd years in pollution protection make this thoroughly clear. In the 1940's and 1950's they concentrated on dilution and "point-of-discharge" treatment for protection against industrial pollutants. In the 1960's they began to consider process improvements and advocated closed cycle processes and non-harmful processes. In the 1970's they proposed comprehensive regional environmental protection, and environmental evaluation and forecasting systems were put into use everywhere. Recently they have gone on to propose "inclusion of environmental protection in development plans" and "eliminating pollution by means of the economic system." The switch from the initial focus on "effective end treatment" to "primary stress on prevention" is called the "second-generation environmental strategy." Naturally, under the capitalist system it is difficult to think in terms of overall implementation. But the socialist planned economy makes this entirely possible. At present, our country's primary problems are as follows.

1. How to promote comprehensive utilization of resources by means of comprehensive prospecting, comprehensive evaluation, comprehensive investigation, comprehensive development, synchronized construction and joint management;

for example, how to establish and develop raw materials and fuels preprocessing departments such as raw coal washing and desulfurization, so that the wastes are separated out at the place of production, concentrated, and recovered for use.

2. The energy structure and the form of heat supply. Wastes from the energy extraction and utilization process are the greatest source of environmental pollutants. More than 70 percent of the sulfur oxides and more than 40 percent of the nitrogen oxides and dust in the atmosphere come from the combustion of fuels. Surveys in some large cities in the north of China indicate that 80 percent of atmospheric pollutants come from fuel combustion. Based on the characteristics of our country's deposits of fuel for motive power and the needs of petroleum export for foreign exchange, for a rather long period domestic energy consumption will continue to be based on coal; direct consumption of coal, particularly in low-efficiency, small-capacity boilers and domestic stoves, is the most serious source of pollution. In view of this conflict, the question of how to improve the urban energy structure and fuel supply methods, e.g. by expansion of the use of natural gas, geothermal power and liquified casing-head gas in cities in which these energy sources are available, and the question of how to develop fossil-fired power stations, pressure coal gasification, industrial waste heat recovery, area heat supply and other diversified methods in areas which lack the abovementioned conditions, in order to gradually change over the cities to the use of coal gas and centralized heat supply, as well as the question of how to develop new nonpolluting or low-pollution energy sources, urgently require solution in order to solve fundamentally the problem of urban air pollution.

3. The geographical distribution of productive capacities and environmental protection. Rational distribution is an important precondition for environmental protection; it helps make thorough utilization of the self-purification capabilities of nature, and promotes comprehensive utilization of resources and centralized recovery and control of the "three wastes." From an environmental protection standpoint, we must focus on effective solution of the following problems: (a) rational setting of the nature, direction of development, departmental structure and scale of cities and industrial bases in accordance with the specific natural and economic conditions of each locality, prevention of excessive concentration and excessive dispersion, strict regulation of the scale of existing cities, active development of satellite cities, and construction of more medium- and small-size cities; (b) effective work in urban planning, districting and layout, preventing the construction of plants which cause serious pollution upwind or upstream of cities or in densely populated districts; (c) clustering together of plants which are closely related in terms of raw materials, byproducts, and use of the wastes, such as: coal mines, minehead power stations and building materials plants which use power station flyash and coal ash; or nonferrous metal refineries and sulfuric acid plants; or areas of logging operations, materials processing plants, and forest products chemical engineering plants; and integrated agricultural-industrial units based on processing of agricultural products, so as to promote comprehensive resource utilization; (d) comprehensive stocktaking of total waste discharge by different types of plants, the relative proportions of the dominant pollutants, and environmental capacities in the vicinity of plants for the purpose of rational plant siting.

4. Gradual improvement of our agriculture's departmental structure, improvement of the proportionality between forestry and livestock raising, and expansion of the area of forested land. The main focuses of agricultural development in various areas should be determined in accordance with their specific characteristics, agricultural production capacities should be rationally distributed, and an organic unity of agricultural, forestry, livestock raising and fishery areas should be established on the basis of the objective laws of ecological cycles. Rational cultivation systems, rational cutting intensities and methods, rational livestock densities and grazing methods, and rational fishing intensities and methods should be established for farmland, forests, grasslands and fishing areas in order to put an end to "killing the chicken to get the eggs" and "fishing by draining the pond" and to integrate resource utilization with protection, nurturance and reform, thus bringing about permanent utilization of renewable resources.

C. Investigation of the Economic Results of Pollution Prevention and Environmental Protection

Improving economic effectiveness is the center of all economic work, and environmental protection work is no exception. Evaluation of economic effectiveness generally uses indicators of economic performance such as the ratio of output to input, gain to expenditure, or benefits to costs. In the capitalist countries this method is called "cost-benefit analysis." When calculating the denominator (i.e. inputs or expenditures), it is necessary to include expenditures of both living labor and embodied labor, to take account of both labor expended and embodied labor committed. Generally total expenditures are expressed in terms of standard expenditure (standard expenditure = annual operating expenditures + funds committed x average profitability of funds). When calculating expenditures, pollution prevention and environmental protection are basically the same as other economic items. The thorny problems encountered in practice generally involve determining shares in investment. Because under many circumstances environmental objectives and other objectives (such as improving labor productivity, decreasing consumption of raw and other materials, improving product quality and the like) are pursued in combination, dividing up these investments which "kill two birds with one stone" requires the use of suitable weighting factors, dividing up the shares among the different objectives and calculating the share that should be allocated to environmental protection. The environmental protection items in the numerator (i.e. benefits, output or gain) differ greatly from ordinary economic items (except that product benefits resulting from recovery and use of the "three wastes" are the same). This is because the result of environmental protection actions primarily are expressed in a lessening of environmental harm, and the effectiveness of lessening environmental harm may be expressed as: (a) benefits from restoration and improvement of natural productive capacities; (b) benefits resulting from improving the living environment, decreasing disease and improving human health; (c) benefits from restoring or improving the natural or social landscape; (d) benefits resulting from restoring or protecting cultural relics; (e) benefits resulting from protection of biological species and communities, and the like. Some of these benefits are short-term and directly manifested, while others appear on the large scale and over the long term. The benefits they yield are very hard to compute correctly and directly in the way in which we say that investment of a

certain amount of funds in industrial construction will yield a certain increase in profit or such and such a net output value; but we must use indirect, roundabout methods to estimate approximate values. Generally, the "functional replacement value method" or "cost value method" are used. For example, the benefit resulting from afforestation used to be calculated in terms of the amount of wood and other forest products obtained after a certain number of years, while now a comprehensive calculation of its benefits in terms of preserving water sources, protecting soil, health protection and treatment, air purification and the like is made. The Japan Forestry Office made a survey of the abovementioned social benefits of forests and calculated them. Some of the methods used by the investigators are worth adopting. In the case of the benefit produced by conservation of water sources, they started by calculating the amount of precipitation stored per unit forest area and total precipitation stored by forests, then used the cost of the functional replacement, i.e. constructing a reservoir (7 yen per cubic meter), to calculate the benefit resulting from water conservation. In the case of soil erosion protection, they used as the functional replacement the building of dikes (400 yen per cubic meter of soil retained) to find the equivalent. In the case of health protection, convalescence and tourism benefits, they made an estimate by the expenditure value method, i.e. they multiplied the number of patients or tourists using forest convalescence or tourism areas by the average expenditure per person. In the case of the benefits produced by the forests' protection of birds and lessening of insect pests, they first calculated the number of birds nesting in the forests and the quantities of harmful insects which they caught, then converted this number of insects to a benefit in terms of the decrease in numbers of insects produced by the forests. In the case of the benefit of air purification, they first calculated the amount of carbon dioxide absorbed and the amount of oxygen given off by forests each year, then used the market price of oxygen to calculate the air purification benefit. Using these techniques they estimated the social benefit of Japan's forest as 12.8 trillion yen, equivalent to the total Japanese budget for 1972. In the United States it was calculated that the social benefit of forests was equivalent to nine times the direct yield of forest products, while the multiple was three in the Soviet Union and two in West Germany and Finland. According to calculations by the relevant departments, the social benefit of our country's forests is equivalent to 7.5 times the total output of the forestry industry and 15 times the output value of timber.

D. Use of Economic Methods for Environmental Management Research

Environmental management requires the comprehensive use of propaganda, education, and administrative, legal, economic and other methods. Each of these methods has functions which cannot be replaced by any of the others. After the People's Republic of China Environmental Protection Law (Provisional) was promulgated, many provinces, municipalities and autonomous regions developed and implemented methods of collecting fees for pollutant emissions exceeding standards, and thereby achieved excellent results in making enterprises control pollution. In addition, the experience of pollution fee collection in the last 2 years has posed many theoretical problems for environmental economics, the core of which is the question of how to understand the nature of pollution fees. Some say that they are a type of tax, while others believe

that they are a fine. As everyone knows, taxes are the main method by which the state organizes its financial revenues and are part of the "surplus product" which enterprises create in the production sphere, while they serve to meet the requirements of the nonproduction sphere and expanded reproduction. Obviously pollution fees are entirely different in nature from taxes. The enterprises' production process is also a process of consumption of raw and other materials, equipment and the like; in order to keep running, an enterprise must continuously buy raw and other materials at a certain price. Similarly, the enterprise production process is also a process of consumption of "environmental resources" and "environmental quality" as a special kind of material, so that the pollution fees are actually the enterprise's payment for consumption of environmental resources and environmental quality. If this approach is valid, clearly the basis for determining pollution fees should be the average amount of social labor expended to reproduce environmental resources and restore environmental quality, which we may call the theoretical price of environmental resources and quality. Using this theoretical price to examine specific policies, the various complex situations in the country at various times and the pollution fees that were set, we can call the "policy-making prices" of environmental resources and quality.

Based on this understanding, pollution fees clearly should be included among production costs and constitute a part of socially necessary labor consumed in production. If an enterprise discharges large amounts of pollutants, if the substances are highly concentrated, and if its pollution fees are high, its production costs should be raised accordingly, and its profit level should drop. For enterprises coming under the experiment in partial retention of profits, the application of pollution fees can link the duty of environmental protection to the economic interests of the enterprise and its employees, so that the enterprise will work actively to control pollution.

By making an objective economic analysis of the state and the individual areas, using the standards described above as a basis for setting pollution fees, and using pollution fees and accidental emission fines to develop a local environmental protection fund and gradually changing over from the current practice of financial allocation to "having the polluters shoulder the burden," and "distribution to polluted areas for their use," we can automatically maintain the balance between the environmental protection fund and the money needed for controlling pollution treatment, and gradually reverse our "environmental protection debt." In economic terms, this debt is really a special kind of "financial deficit."

In addition to pollution fees, the use of incentives for recovery and utilization of wastes and the issuance of no-interest or low-interest loans or financial subsidies for the construction of waste control facilities are other instances of the use of economic measures, but these will not be discussed here.

V. Environmental Work During the Readjustment Period and Environmental Economics

The putting forward of the guidelines of readjustment, reform, reorganization and upgrading constituted a fundamental turning point in the guiding ideology

of our country's economic construction. The 10 points which Comrade Zhao Ziyang enunciated at the Fourth Session of the Fifth National People's Congress further indicated the new route of our country's future economic construction. In environmental protection work too there is the problem of discovering a route that is in accord with this country's circumstances. The State Council's "Decision on Intensification of Environmental Protection Work During the Period of Readjustment of the National Economy" of February 1981 pointed out in principle several main problems of our future environmental protection work.

A. Controlling the Development of New Pollution Sources in Connection With Contraction of the Scale of Capital Construction

The readjustment of the national economy began with solving the problem of overextension on the capital construction front, contraction of the overall scale of capital construction and readjustment of investment orientation. In weeding out capital construction projects, the environmental protection departments have both the right and the duty to suggest that construction projects which are irrationally laid out, which severely pollute the environment and which lack effective pollution control measures be stopped or slowed down. With reference to other large, medium and small-sized projects which are being continued or are starting, they should stringently establish the "environmental impact statement" reporting and permission system in accordance with the procedural guide "Environmental Protection Management Methods for Capital Construction Projects," hold the line on the "three simultaneous" efforts and control the appearance of new pollution sources.

B. Solving Some Prominent Pollution Problems in Connection With Industrial Readjustment and Reorganization

During readjustment, in order to solve the problems of unevenness in the various departments and areas, we must pursue complementary measures and implement the policy of shutting down, stopping production, combination and retooling. Enterprises which have no assured source of raw materials, whose products are unmarketable, which have posted losses for a long period, and which pollute the environment should be made to close, cease production or shift production; plants which have assured supplies of materials and guaranteed markets but which are irrationally located and which pollute the environment may be made to combine or move. For example, Jinan City made seven chemical engineering plants which were upwind or upstream of the city change products or alter their production, considerably decreasing pollution within the city.

Reorganization and integration of industry requires that the previous enterprise organization into small or large self-sufficient units be rectified, with reorganization on the principle of specialization, cooperation and economic effectiveness, thus making enterprise organization more rational.

The environmental departments have a major role in connection with the important undertaking of readjustment of the national economy. For example, many of our plants now have their own technical support bases, such as casting and forging shops and electroplating shops; these small, scattered shops not only

have low efficiency and low materials utilization rates and produce serious pollution, but because the total amount of the wastes is limited, in view of the economic scale of pollution control they can acquire the requisite purification or recovery equipment only by specialization, cooperation and centralized production. For example, Tianjin City combined 110 electroplating workplaces into a specialized plant, thus decreasing its pollutant emissions by 400,000 tons a year, saving 1.5 million kilowatt-hours of electrical energy, decreasing electroplating costs by 10 percent, and reaping both environmental and economic benefits.

C. Actively Promoting Pollution Control in Older Enterprises in Connection With Enterprise Technical Modernization

In the past our country's economic development was based primarily on plant construction and we pursued expanded reproduction of the extensive type, ignoring renovation and modernization of older enterprises. This was one of the main reasons for our low economic effectiveness. A major change in our future path of economic construction is the requirement to shift our main effort to re-equip and modernize older enterprises. The objective of renovation and modernization is not only to improve efficiency and modernize products, but to decrease raw materials and fuels consumption and decrease or eliminate pollution. The environmental protection departments should actively involve themselves in this work; by altering their raw materials policy and process policy in accordance with the specific characteristics of each plant, they can improve resource and energy utilization efficiency and promote process modernization and equipment replacement, while at the same time decreasing pollution factors in the production process, so as to unify environmental performance, conservation performance and economic performance. Emission of wastes during energy utilization is the most important source of pollutants, and the most urgent objective is the pursuit of technical modernization focusing on conservation; the experience of many enterprises such as the Anshan Steel Works, the Shenyang Smelting and Refining Plant and the like have already demonstrated that this is a pollution control route which requires little investment, produces a rapid return, and is practicable.

D. Improvement of the Urban Environmental Situation in Connection With Readjustment of Urban Economic Structure and Urban Planning, and Identification of a Route to Comprehensive Regional Pollution Control

Shortly after Liberation the general policy of "converting consumer cities into producer cities" was proposed for urban construction; initially it produced a positive effect, but subsequently this policy was made absolute and was oversimplified, the different conditions of different cities were ignored, and all of them were focused on industry--particularly heavy industry--with the result that even a city like Beijing, the governmental center of the entire country, came to have a heavy-industrial economic structure. Cities like Hangzhou, Suzhou and Guilin, which were world-famous tourist attractions, also had large amounts of heavy-polluting plants built in them, in addition to which large-scale neighborhood industry was pursued on certain occasions, and the principle of "inserting a needle wherever there was a crack" was followed, so that many seriously-polluting plants, or plants which produced large

amounts of vibration and noise, were scattered through densely-populated areas, cultural and education areas, commercial areas or even scenic areas, greatly degrading the urban environment. The serious disproportion between "bones" and "flesh" [productive and nonproductive construction projects] was also an almost universal problem in the cities. In the future the cities' economic structure will be readjusted; in accordance with the spirit of the national urban planning conference as circulated by the State Council in October 1980, the cities are studying their own characteristic structure and scale and revising their overall plans. This is the first link in an overall improvement of the urban environmental situation, and the environmental departments are participating in it, drafting overall urban environmental plans and carrying out effective environmental protection work in connection with urban functional zoning, and the readjustment and improvement of heat supply systems, underground and above-ground water supply systems and planning programs. They should encourage neighborhood industries whose pollution annoys the people and which have major conflicts with the inhabitants to change to nonpolluting, tertiary industries which aid the people.

E. Pursue Rational Utilization and Protection of Natural Resources in Connection With Readjustment of Agricultural Structure and Geographical Distribution

In the past, because the approach to agriculture was limited to existing arable land and the grain-growing industry, the approach was to "treat grain as the key item and ignore everything else"; under such slogans as "Demand grain from the uncultivated mountains," "Demand land from the river banks," "Establish small manmade plains" and the like, the forests were destroyed and uncultivated lands opened up, livestock raising was abandoned for grain growing, and lake-bottom land and sea areas were reclaimed with dikes, with the result that agricultural production was devastated, serious damage was done to natural resources and the ecological balance, and floods, drought, erosion and desertification were made more acute. In the 9 years from 1950 to 1958, the total area influenced by such disasters each year did not exceed 500 million mu, and the area directly involved in disasters only exceeded 150 million mu in 3 years; in the 6 years between 1972 and 1977, the area influenced by disasters exceeded 500 million mu in 4 years and the area directly subject to such disasters exceeded 1.5 million mu in 3 years; the area subject to soil erosion increased to 900 million mu, with an average of more than 5 billion tons of soil eroded every year, taking with it about 40 million tons of nitrogen, phosphorus and potassium fertilizers annually, roughly equivalent to the country's fertilizer output for an entire year. The area of desert increased from 1.6 billion mu shortly after Liberation to 1.9 billion mu. Lake-bottom reclamation caused the nation's lake area to decrease by more than 20 million mu, in addition to which excessive cutting of forests meant that severe thunderstorms were likely to produce flooding. Two lake floods in 1980 inundated 32.2 million mu of agricultural land, and in 1981 there was a succession of floods in Sichuan, Shaanxi and Heilongjiang, with the direct losses in one flood in Sichuan alone exceeding 2 billion yuan. This was nature's punishment of us for excessive violation of ecological laws in agricultural production and water conservancy construction; it is a signal that well merits attention. We must set right the past small-scale agriculture attitude of "growing only one type of crop" and establish the large-

scale grain-growing, large-scale agriculture approach, which can mobilize and protect natural productive capacities and also yields great economic benefits. In recent years, under the guidance of the policy of "no slackening of grain production, but active development of diversified agriculture," our country's agricultural structure and its geographical distribution have been undergoing steady readjustment. Starting in 1979, under the leadership of the agricultural commissions at all levels, an immense contingent of more than 100,000 persons was organized to carry out a survey of the country's soil, climates, water resources, forests, grasslands, other biological resources, and local and specialty products, in order to carry out agricultural districting work; the document "National Comprehensive Agricultural Districting" has already been put into draft form. This document divides the entire country into 10 Class 1 districts and 38 Class 2 districts. Province-level comprehensive agricultural districting has already been proposed for 22 provinces and autonomous regions, and county-level agricultural districting work has been done for 70 percent of all counties. This districting project not only provided data for readjustment of agricultural distribution, but also created favorable conditions for environmental protection work involving an expansion from waste control work to comprehensive organization, development, utilization and management of the entire national territory, and for advancing environmental protection work to a new stage.

BIBLIOGRAPHY

1. Marx, K. "Das Kapital," Vol 1, "Complete Works of Marx and Engels," Vol 23, p 57.

2. Engels, F. "The Dialectics of Nature," Cao Baohua et al., translators, 1961, p 137.

3. Marx, K. "Das Kapital," Vol 1, "Complete Works of Marx and Engels, Vol 23, p 201.

4. Marx, K. "Das Kapital," Vol 2, "Complete Works of Marx and Engels," Vol 24, p 398.

5. Marx, K. "Das Kapital," Vol 3, "Complete Works of Marx and Engels," Vol 25, pp 926-927.

6. Engels, F. "The Dialectics of Nature," "Complete Works of Marx and Engels," Vol 20, p 521.

7. Engels, F. "Anti-Duhring," "Complete Works of Marx and Engels," Vol 3, p 335.

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RELATIONSHIP BETWEEN HEALTHY ECOLOGICAL ENVIRONMENT AND SOCIALIST MODERNIZATION DISCUSSED

HK250630 Beijing RENMIN RIBAO in Chinese 18 Feb 83 p 5

[Article by Xu Dixin [6079 3321 2450]: "Socialist Modernization and Ecological Environment"]

[Text] In November last year, the Economic Research Institute and Agricultural Economic Research Institute of the Chinese Academy of Social Sciences and the Chinese Association of Environmental Protection jointly held the first national symposium on ecology and economy in Nanchang. More than 100 natural scientists and economists attended the meeting. In the course of the meeting, many noted natural scientists, agronomists and forestry experts aired many excellent views and suggestions. They were very much concerned about the problem of ecological balance which China is facing today. However, they also profoundly realized that in improving our ecological environment, it would be difficult to achieve the desired aim if we relied unilaterally on the efforts of natural scientists. The serious disproportion in our ecological environment has been caused by serious shortcomings in economic work and the solution of this problem makes it necessary for our economic work to bring about a fundamental change in this respect. In the economics circle, there are also a lot of people who are aware of the seriousness of the disproportion in the ecological balance and the urgency of solving this problem. As a matter of fact, the party and state have attached great importance to the problem of ecological balance. In his report to the 12th Party Congress, Comrade Hu Yaobang stressed the necessity to "protect all agricultural resources and maintain the ecological balance." In Article 26 of the new constitution it is explicitly stipulated that "the state protects and improves the living environment and the ecological environment, and prevents and remedies pollution and other public hazards."

However, quite a few comrades engaged in economic work fail to understand the importance of ecological environment work and thus act more or less blindly in their work. This finds most concentrated expression in seeking the growth of output value without attaching importance to economic results, still less environmental portection and ecological balance; in paying attention to the economic results of their own units or localities without attaching importance to ecological results, that is, the overall and long-term economic results. The reason for this is the failure to foster a clear-cut ecological idea in the economic work.

Relationship Between Economic Work and Natural Environment

The most fundamental economic work is the production of various material wealth. In the course of material production, it is necessary to enter into a certain relationship with the surrounding natural environment. In practical economic life, a large number of people engage in material production year in year out and come into contact with the natural environment and yet they give little consideration to the relationship between material production and natural environment. Many people who engage in industrial production, in particular, always think that their productive activities have little to do with, or have no direct bearing on, the natural environment. As a matter of fact, people's productive activities cannot depart from the natural environment. They have a very close relationship with the natural environment. Marx said: The labor process "is human action with a view to the production of use-values, appropriation of natural substances to human requirements; it is the necessary condition for effecting exchange of matter between man and nature; it is everlasting nature-imposed condition of human existence, and therefore is independent of every social phase of that existence, or rather, is common to every such phase."* That is to say, human productive activities are formed by two aspects: "Man and his labor on one side and nature and its materials on the other."** In this analysis, Marx not only showed that there is an internal relationship between material production and nature, but that material production itself is, in the final analysis, an exchange of matter with nature effected by man through labor. Therefore, it is not sufficient for the comrades engaged in economic work, particularly comrades engaged in material production, to understand the economic results of their own units. They should gain a basic understanding of the mutual relationship and exchange of matter within the entire ecological system. Only in this way will it be possible for them to rise above the original level and avoid negative economic results, and constantly go on discovering and advancing. What is referred to as the ecological system includes not only the mutual relationship between animals and plants on the one hand and their environment on the other, but also the mutual relationship between man forming into socieites and their environment. What is referred to as the natural environment or environmental system is a system formed by the mutual reactions of light, heat, air, water as well as various organic and inorganic elements in nature. In modern times, in attaching importance to the ecological system, we stress the relationship between people engaged in production and the natural environment, as well as the exchange of matter between man forming into societies and nature, particularly the exchange of energy. Only thus will it be possible to achieve better results and rationally utilize and adjust the natural resources provided by nature. This makes it necessary for our comrades engaged in economic work to have a clear-cut ecological idea. Whether or not one has this

*"DAS KAPITAL," Vol 1, pp 208-209.

**Ibid., p 209.

idea is quite different. If one has this idea, one is sure to have a wider and longer field of vision; if one fails to have this idea, one is bound to have a narrow field of vision and inevitably act blindly. We do not advocate natural selection by holding that the existense of things in nature is rational and conforms to the ecological balance. On the contrary, we favor transforming nature and the environment in order to suit the needs of human development. This transformation of the objective world precisely distinguishes man from an animal. However, the transformation and utilization of nature by man is not tantamount to blind extortion and even predatory exploitation of nature. In the past, due to the low levels of productive forces and scientific research as well as the restriction of people's cognitive ability and material conditions, it was hard to avoid the above-mentioned phenomena. However, with the development of the times at present, the material conditions created by man and the cognition ability derived from this have reached a fairly high standard. We should not again take the beaten track, particularly the beaten track in the initial period of industrialization but, while transforming and utilizing nature, protect natural resources, set up a more rational ecological balance and achieve continuous utilization of the natural environment.

Relationship Between Economic and Ecological Results

In order to achieve socialist modernization and quadruple the gross value of industrial and agricultural production by the end of this century, it is necessary to vigorously carry out the transformation of industrial and agricultural technology and energetically protect and improve the living and ecological environment. For a number of years in the past, we only paid attention to output and value in socialist production and construction but overlooked economic results. After the 3d plenary session of the 11th CPC Central Committee, the comrades engaged in economic work began to attach importance to economic results. This is extremely gratifying progress. For the sake of overall and long-term interests, we hope that, while attaching importance to economic results, they will also pay attention to ecological results. In stressing ecological results, it is necessary to pay attention to maintaining the balance of the ecological system. The ecological system is an entity of various mutually related aspects. Circulation and exchange of energy and matter go on in nature among various kinds of living things and non-living things and between living and non-living things in the course of mutual contact and influence. Maintaining, for a considerable period of time, the various functions of the ecological system in a balanced condition of mutual adaptation and adjustment will stabilize the self-adjusting ability of the ecological balance, strengthen the growing ability of various kinds and quantities of organic matter and enable man to continually obtain rich material products and have a good living environment. In this way we can attain the best economic results. Quite a few comrades still fail to understand this principle. They take great pains in adopting many measures in an attempt to improve economic results. However, due to the fact they overlook the ecological results and act in a way that defeats their purpose, they gain in this but lose in that. More often than not, the loss outweighs the gain. For example, our state produces tens of

millions of tons of chemical fertilizer to make up for the loss in soil fertility. However, as a result of indiscriminate felling of forests, the nutrient contained in the 5 billion tons of farmland topsoil washed away annually is equal, in terms of chemical fertilizer, to the annual output of chemical fertilizer in the country. In quite a few localities, dykes have been built to reclaim land from lakes. The original intention was to increase grain production. However, reduced water surface has not only reduced fish output but aggravated floods and waterlogging, which in turn have adversely affected grain output. On the one hand, many localities spent a lot of manpower and material resources in building reservoirs; on the other hand, they destroyed forests to open up land, resulting in the loss of soil and silting up of ponds and reservoirs. In a few localities, commune members catch frogs, owls and yellow weasels. Although this can increase the income of peasants, the disappearance of birds and frogs and the rampancy of insect pests adversely affect the harvest of farm crops. Other things, such as the destruction of forest trees and farm crops caused by air pollution, the disappearance of fish and shrimps due to water pollution and the destruction of good farmland and the contamination of waterheads by the dumping of waste residue, infringe upon economic results. Naturally, good practice has also been effected in quite a few places. For example, the practice of breeding trichogrammas for the elimination of corn earworms can eliminate insect pests and increase income. It will not cause pollution. The development of marsh gas not only can help solve the problem of firewood in the rural areas and enrich the soil with the compost of stalks, but also reduce the application of chemical fertilizer. This is an act of killing several birds with one stone. Many facts prove that ecological results serve as a material basis for economic results and paying attention to ecological results constitutes an important condition for ensuring economic results. If ecological results are undermined, it will be difficult to ensure economic results.

Relationship Between Bringing Pollution Under Control and Utilizing Natural Resources

The development of modern industry and agriculture will inevitably bring with it various side effects, such as environmental pollution. With the development of modern industry and agriculture, the discharge of "waste gas, waste water and industrial residue" increases year by year and environmental pollution becomes more serious with each passing day. The worsening ecological environment and the disruption of the ecological balance became a serious worldwide problem long ago. We should not, like some people in the West, oppose the modernization of industry, agriculture and communications and transport by turning back the wheel of history and advocating a return to the age of worship handicraft industry. Nevertheless, we should assume a positive attitude toward the question of bringing existing environmental pollution under control. At the same time, we should not follow in the footsteps of the Western countries by continuously taking a roundabout course of "pollution first and management second." The longer we take a roundabout course, the living and ecological environment will deteriorate further and the damages done to natural resources and the health of the

people will be more serious. When we start bringing the pollution under control, the cost we pay will also be greater. Some comrades think that bringing pollution under control is a losing transaction. Other comrades think that they are helpless about bringing pollution under control and therefore hesitate on improving the environment. This is an incorrect attitude.

Can we gradually eliminate pollution and protect and improve the living and ecological environment in the course of the modernization drive? The answer is yes. Is bringing pollution under control and improving the environment a losing transaction? The answer is no. The reason lies in the fact that we are now by no means incapable of maintaining the ecological balance and that bringing pollution under control can be integrated with the comprehensive utilization of natural resources. As for the "three wastes," we can use various methods to reduce their harm and turn the wastes into valuable things by utilizing them. For example, by improving the utilization rate of coal burning, we are able not only to reduce the discharge of waste gas but also save on coal. By recovering the waste gas with our equipment, we are able not only to control the discharge of waste gas within a certain scope but also utilize the useful elements in it. Through purification of water, the purified industrial waste water can be utilized in the closed circulatory system. By doing so we are able not only to reduce the pollution of waste water to a minimum, but also save on water and alleviate the contradictions caused by insufficient water resources in many cities. Now, our country must spend a lot of foreign exchange annually in importing sulphur for the manufacture of sulphuric acid. However, the sulphur dioxide we discharge into the air along with waste gas amounts to 14 million tons annually, that is, 7 million tons of sulphur. There has always been a great gap in our production of caustic soda. For many years in the past, our country imported several hundred thousand tons of caustic soda annually. However, more than 600,000 tons of caustic soda is discharged annually from the paper-making industry along with waste water. By improving our rate of recovering caustic soda from the paper-making industry to the advanced level of foreign countries, we shall be able to recover 400,000-500,000 tons of caustic soda annually. All these are undertakings which kill two and even three or four birds with one stone. Judging from the present conditions in our country, the serious pollution in many industrial enterprises has been caused partly by faulty management of enterprises and failure to pay attention to the waste of energy and material and partly by backward technology and obsolete equipment so that loss and waste of energy and chemical elements are extremely serious. Therefore, in consolidating enterprises, it conforms to both ecological and economic results to have a good grasp of technological transformation, control pollution and utilize natural resources. Some technological measures may not yield good economic results if they are calculated from the angle of an individual enterprise. However, they are worthwhile if calculated from the angle of the whole region and social economic results.

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NANCHANG MEETING EMPHASIZES RELATIONSHIP BETWEEN ECOLOGICAL BALANCE AND ECONOMY

Beijing RENMIN RIBAO in Chinese 31 Dec 82 p 5

[Article by Wang Dengsan [3769 4098 0005]: "China's First Ecology and Economics Conference Held in Nanchang"]

[Text] China's first ecology and economics conference was held in Nanchang in mid November 1982. More than 100 natural scientists and economists investigated China's economic construction from an ecological economics viewpoint.

It was held that ecological balance is the objective basis for economic balance. Resources can be utilized rationally and in the long term economic interest only when the ecological balance is maintained. Between ecological balance and economic efficiency, ecology plays the major role; if the ecological balance is disrupted, the loss will definitely fall on the economy. In the past, since the guiding ideology neglected the unification of economic efficiency and ecological benefit, the ecological balance was badly disrupted and the environment was seriously polluted, leading to extremely grave losses in economic development. Now the 12th Party Congress political report has called for the protection of agricultural resources and the ecological balance. Our indisputable obligations, therefore, include strengthening ecological scientific research and combining it with other academic disciplines, and proposing objective, feasible and rational suggestions.

It is believed that, in order to realize the strategic goal of all-out economic growth set by the 12th Party Congress, we must first improve the understanding of the strategic significance of ecological economy by the entire party and the entire population. In the last 30 years, an important cause for the damage to the ecology was the lack of understanding of the economic significance of ecological balance. It is vitally important to improve education in this area. The ecological problem is fundamentally solved only when ecological and economic theories are transformed into conscious actions by the people. Popularized educational material on ecology and economics should be written and widely publicized using various media. The conference participants felt that the initiation of a county-wide ecology and economic survey project and holding academic study groups taken by Fengdu county, Sichuan Province, were good and should be extended to other qualified places.

Second, the concept of ecological balance must be firmly established among economics workers and be used to guide the effort in economics. Today, many of our comrades think of extra burdens as soon as they hear the term ecological balance. They do not understand that treating pollution, maintaining a rational ecology and utilizing the resources rationally will lead to better economic benefits. Unilateral pursuit of economic interests is always detrimental to the overall long term economic benefit and does not pay off. Many production and construction enterprises spent a great amount of manpower and material to do unwise things and learned a hard lesson from nature. We should remember the lessons of the past and instill the concepts of ecological and economic benefits into every economic project. Each development project must be proved not only on technological economic grounds but also on ecological economic grounds. Agricultural development must pay close attention to biological practices to protect resources and maintain ecological balance. The conference participants stressed that all our economic policies are related to ecological balance. For example, improperly set commodity price may lead to grave consequences in ecology and economy.

Third, devote the next 10 years to a few ecological economic projects of great urgency, with long lasting effects and pay off such as the Huang He valley project, urban pollution problems, and the proper deployment of tropical crop resources in Hainan Dao and Xishuangbanna. After sufficient preparation, these problems should be solved thoroughly.

Fourth, improve ecological and economic research and train personnel in ecological economy. Based on the practice and experience in economic construction, gradually establish an academic system on ecological economy in China. The great need of ecological economists is in the rural area. We should modify the rural secondary school system, open up a large number of agricultural secondary schools to train students in agricultural specialties and on the basic knowledge of agricultural ecological economy.

9698
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ECOLOGY ECONOMICS EXPLAINED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983 pp 62-64

[Article by Zhang Jianguo [1728 1696 0948], Fujian Academy of Forestry: "Forest Ecology Economics (1): Introduction to Ecology Economics"]

[Excerpts] Problems Now Facing Ecology Economics

Up until the time of the Third Plenary Session of the 11th Party Central Committee, for reasons known to all, subjectiveness in excessive desire for quick results impelled the country to actions in farming, forestry, animal husbandry, and the fishing industry that, to one degree or another, contravened the laws of ecological balance. This, plus natural and historical reasons, led to serious imbalance in the ecology, which was conspicuously manifested in the following ways:

1. Serious destruction of forests, which has not yet been halted, with the result that multiple ecological benefits obtained from forests have been seriously damaged.

2. Continuation of soil erosion, many places bringing it under control on the one hand only to cause more damage on the other. Sometimes the destruction was greater than the control. Not only was the situation in the loess highlands not improved, but in the Yangtze Basin where natural conditions are superior, erosion steadily mounted.

3. Destruction of steppelands producing serious desertification of the soil. Overgrazing that caused regression of the grasslands continued apace. Today 158,000 square kilometers of soil is in danger of becoming desert.

4. Improper management of the use of water conservancy resources. In addition to the destruction of forests to clear land for farming, the destruction of grasslands to clear land for farming, and the clearing of steep slopes for farming, which caused

erosion, flooding, and waterlogging disasters, many places filled in lakes to make farmland, reducing water surfaces without regard for the consequences. This situation reduced particularly severely the capacity of the main channel of the Yangtze River to absorb flood waters, and increased the danger of flooding for the people on both banks.

5. Emphasis on use while slighting nurture of the soil resulting in a decline in soil fertility. In many places, flood irrigation and poor drainage resulted in serious secondary alkalinization and salinization of the soil.

6. Taking too large catches of aquatic products, which brought about destruction of aquatic product resources.

7. Serious pollution of water resources resulting from lackadaisical handling of the "three wastes" of urban industry [waste gas, waste water, and industrial residue], and large scale use of agricultural insecticides. As a result of excessive extraction of ground area in some parts of north China, the water table fell precipitously. This not only hurt agricultural production, but also affected the use of water in people's daily life.

8. As a result of improper drainage and irrigation practices, China's salinated fields have not only not decreased, but the land is danger of salinization has increased.

9. Environmental pollution became fairly serious.

10. Population grew too rapidly, etc.

Clearly, in China's cities and countryside alike, the ecological imbalance is serious. Only by recognizing clearly the seriousness of these problems will it be possible to increase our understanding, to carry out better the CPC's call to preserve ecological balance, to make full use of the superiorities of the socialist system, and to promote an all-around upsurge in the building of socialism. Ecological balance is an essential expression of the dynamic development of the ecosystem. In the relationship between ecological balance and economic balance, it is the former that is basic. This is because real lessons have demonstrated time and again that once the ecology is imbalanced, inevitably economic ramifications will occur, and thus the entire national economy will incur tremendous losses.

However, it must be realized that that we have many achievements to our credit since Liberation in maintenance of ecological balance and restoration of a benevolent cycle to the ecology, and we have gained numerous valuable experiences too.

First, construction of the national farmland shelter forest system has become a mainstay of the country's agro-ecosystem. It protects one-sixth of the country's farmland area, and has been widely praised internationally.

Second, is model transformations of the loess highlands. As a result of efforts made ever since Liberation, Xigou Brigade in Mizhi County, Shaanxi Province has built a "three, three system" as part of its agro-ecosystem to lift itself out of the status of being a poor mountain community with bad water. It changed its proportions of grain, forests, and grasslands from the 8:1:1 ratio of 1958 to 3:3:3. The people's standard of living has risen tremendously; the natural landscape has completely changed for the better, and this has opened glorious prospects for development of the entire loess highlands.

Third, has been development of fishponds based on mulberry trees (or fruit trees, or sugarcane), and the intercropping of fruit trees and grain or forest trees and grain, and the building of such man-made ecosystems, which have attracted increasing attention and study.

The foregoing real cases reveal the intelligence and creativity of the broad masses of China's people, and naturally it cannot be denied that this has been the result of an understanding of natural inevitabilities.

Thanks to the foregoing positive and negative lessons of experience, ecology economics problems in China have been given serious attention once they have been raised, and numerous comrades have had heartening results from the study of ecology economic problems in farming, forests, and grasslands, some of which are in process of being put to use. These results have been gained in the short space of 2 or 3 years, once again attesting to the tremendous superiority of the socialist system in returning the ecology to development of a benevolent cycle. Naturally, in China with its large population, slight accumulated wealth, and with a history of of fairly serious imbalance in its natural ecology, as well as definite limitations imposed by its economic and cultural levels, any thought of completely solving these problems will require arduous toil, and will also require wideranging and thorough study.

The main problems now facing ecology economics are as follows:

First is problems pertaining to agro-ecology economics.

The soil erosion problem has seriously impaired development of China's agricultural economy. Today, soil erosion and environ-

mental pollution are two of the world's major ecology economics problems. China's environmental pollution problems are not small, and soil erosion is even more serious. It has been calculated that China annually loses 5 billion tons of soil through runoff. This is one-fifth of the world's 25 billion ton total. Consequently, how to extricate ourselves from the vicious cycle, and how to develop grain, forestry, animal husbandry, and fisheries in an integrated large scale agriculture has become the first problem for ecology economics to solve.
Second is energy ecology economic problems

One problem is atmospheric pollution caused by the burning of coal in cities and towns, and a second one is the imbalance of the ecology caused by the burning in rural villages and mountain regions of the stalks and stems of crops and firewood. One basic way in which to solve the fuel pollution problem is by making all-around use of them as, for instance, by washing coal, dressing coal, recovering sulfur from coal, and gasification of coal. Another way is the building of firewood forests, development of small hydroelectric power plants, and development of biogas, all of which are effective ways in which to solve rural energy problems. Naturally solution to problems of this kind cannot be done by rushing into rash action, but rather require full study of conditions everywhere for gradual implementation.

Third is economic problems in the prevention and control of industrial pollution, etc.

4. The Academic Discipline of Ecology Economics

Ecology economics is an applied science. It uses the interrelated roles of ecological laws and economic laws to analyze the relationship of costs to benefits in the flow of matter and energy in the ecology economic system and the economic inputs and outputs. It applies systems science, control theory, and information theory to build economic models and to select optimized programs. Thus, it is an applied science.

Inasmuch as ecology economics has as its object of interest ecology economic systems formed of a combination of an ecology system and an economic system, the branching of this discipline must be founded on distinctions among types of ecosystems.

Currently, in addition to overall research on ecology economics, scientists have begun research in many individual fields to produce individual branches of learning in the field of ecology economics. Examples include agricultural ecology economics, forestry ecology economics, steppe ecology economics, urban ecology economics, etc. Since individual fields of study and under-

standing differ, the fields may be differently termed both farmland, forest, and grassland ecology economics and agriculture, forestry, and animal husbandry ecology economics. They all function in accordance with basic ecology economic principles in carrying out specialized study of individual kinds of ecosystems (that may be termed sub-systems). Forest ecology economics is one such branch discipline. The branches and the overall science are mutually advancing and interdependent.

During the past 2 or 3 years,as people's understanding has increased, China's study of ecology economic questions has deepened somewhat, and some heartening advances have been made particularly on farming, forestry, and animal husbandry ecological problems. One may be confident that with the deepening of research work, we will certainly be able to make the contributions we should in ushering in a new situation in the building of socialist modernization.

9432

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STRATEGIC ASPECTS OF ENVIRONMENTAL PROTECTION OUTLINED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 12, 1982, pp 2-3

[Article by Sun Jiamian [1327 0857 4875]: "A Strategy for Environmental Protection"]

[Text] A strategy for environmental protection is an important issue that has been proposed in the wake of drawing up the strategy for China's economic and social development. Strategy is a military term. It is the overall plans and tactics to direct the war and the general planning of major tasks. At present, it is widely used in many realms. All problems of a nation, a sector, a region and an aspect that are overall, comprehensive and of long-term significance are called strategic questions. Environmental protection is an overall, comprehensive and long-term problem throughout the nation, therefore, it is a strategic question. Generally speaking, the strategy for environmental protection is a part of the general national strategy for economic and social development and a scheme that puts forth the major goals to be realized in environmental protection and the steps and important measures to realize these goals over a relatively long time, such as 10 years, 20 years or even longer. It is actually a macrocosmic, comprehensive, whole and long-range plan.

Why do environmental management departments have to study and draw up environmental protection strategies? First, prevention and control of pollution, environmental protection, and maintaining ecological balance are long-range tasks. Because there are many factors that affect the natural environment, environmental quality will fluctuate frequently. Within a definite period environmental quality is good, but after being affected by a certain factor, it may possibly worsen. Therefore, within a short time, we can only measure the changes in environmental quality within a small realm. To precisely evaluate the change in environmental quality in a large area and its trends, especially changes in ecological balance, takes a longer time. At present, many nations are studying and drawing up environmental protection strategies. China has begun to discuss, study and draw up strategies for economic and social development. The State Council has decided that the whole nation, from the highest level to the lower echelons, should draw up strategies for economic and social development over the next 20 years, including an environmental protection strategy. Therefore, drawing up environmental protection strategies has become an important task facing our environmental protection sector.

Second, environmental protection is a comprehensive task. It requires profound thinking and careful planning, overall consideration and coordination. Environmental protection in the area of management deals with the economy, society, politics, science and technology; it involves all the sectors and all regions of the nation. The components of management include the atmosphere, bodies of water, soil, living organisms and various environmental elements. Therefore, we must uniformly plan and handle the various types of relationships between environmental protection and economic and social development in a coordinated way, for example, the productive relationship between environmental protection and industry and agriculture, the relationship between environmental protection and economic benefits, the relationship between environmental protection and population growth, and the development of resources and energy. This requires coordination between sectors and between regions, and there must be a long-term strategic plan. Now, more and more economists, sociologists, ecologists and scientific and technical experts in the world are exploring this problem. We must consider this problem as soon as possible.

Third, to build a high level socialist material and spiritual civilization, to realize the four modernizations, to quadruple the nation's total output in industry and agriculture by the end of this century, environmental protection work must make rapid strides to catch up. The heavy tasks of preventing and controlling various types of environmental pollution and protecting ecological balance are facing the nation's environmental protection workers. By the year 2000, what goals should be reached, what paths should be followed, what steps should be taken, what countermeasures should be implemented, what would be a rational environmental management system for the nation's environmental protection? We must scientifically answer these questions on the foundation of summarizing the experience in environmental protection work over the past 10 years, propose ideas for creating a new situation in environmental protection work. These are all starting points in answering why we must study and draw up environmental protection strategy.

What should the guiding ideology and tactical principles be in drawing up the nation's environmental protection strategy? First, the drawing up of an environmental protection strategy must proceed from the actual situation in China and be based on the strategy for economic and social development in the nation and the long-term plans for national economic development. At the same time, the environmental protection strategy is also an important component in the whole strategy for economic and social development, and it supplements and strengthens the strategy for economic and social development. The development of environmental protection must be consistent with the level of development of social productivity, be coordinated with the level of science and technology, and be suited to what the state can provide in material and money. We must never use methods that pollute the environment, that damage the ecological balance and that destroy natural resources to develop the economy and increase production. And we must not make too many and too quick demands on improving environmental quality.

Second, in the relationship between development and the environment, we must implement the strategic principle of "sychronous" solutions. This means, we must simultaneously solve the problems of industrial environmental pollution, urban environmental pollution, environmental destruction and impact and maintain the ecological balance well in readjusting and reorganizing the national economy, in technical improvements of industrial and communication enterprises, in renovation of equipment, in urban planning, construction and improvement, in building new, expanding and rebuilding projects, in the development and utilization of resources and energy, and in the development of agriculture, forestry and animal husbandry. We must not solve these problems outside of the development of these sectors or after the development of these sectors. We must solve these problems during the development of these sectors.

Third, we must insist on the ideology of unifying environmental results and economic results. We must conscientiously remember that in the past a few units separated environmental protection and increased production, and the lessons and experience in separating environmental results and economic results. We must select those ways of comprehensive protection and control which can realize environmental results, social results and economic results. Economic results must include those that can be realized in renovating technological processes of industrial and mining enterprises, comprehensive utilization of resources and energy, improvement of health standards for workers and productivity, and must also include the external economic results brought about by the improvement in environmental quality, the reduction of loss in industrial and agricultural production, the improvement of health standards for the masses, and the protection of social stability.

Fourth, we must adhere to the principle of self-reliance to prevent and control pollution, and protect the environment. We must establish appropriate environmental policies and systems, fully develop the enthusiasm, self-awareness and initiative of the leadership, the workers and supervisory departments of discharging units to eliminate pollution and protect the environment, and to regard the prevention and control of pollution as a part of one's own production task and as a duty to society.

What should the substance of an environmental protection strategy include? First, we must draw up strategic goals for environmental protection based on the strategic goals for economic and social development in the nation, and divide its implementation into several stages, for example, environmental goals during the period (up to 1990) to build a good foundation for the national economy, to accumulate strength and to create conditions, environmental goals during the period of a new economic revival (up to the year 2000), and environmental goals for even longer periods (such as 30 years, 50 years). Second, we must establish several key projects in environmental protection during each strategic stage, for example, designating key industries for preventing and controlling pollution, pinpointing construction projects that may cause serious damage to the environment and development projects that will visibly affect the ecology; establishing key regions of environmental pollution and destruction for control; etc. Finally, we must draw up some major policies and measures for environmental protection, such as urban

environmental policies, environmental policies for energy (including nuclear energy), environmental policies for resources development, environmental policies for chemical fertilizers and pesticides, and environmental personnel policies. We must perfect environmental laws, plans for a system of environmental standards, establish and perfect plans and measures for a system for continuously monitoring and forecasting environmental quality, and draw up major projects for scientific research needed to realize the environmental protection strategy.

As an example of drawing up strategies for environmental protection and economic and social development, we can study the book "Reformation of the Islands" written by former Japanese prime minister Kakuei Tanaka and published in 1972. His strategic goals, principles and measures were: The development of post-war Japanese capitalism brought about an over-concentration of industry, population and cities along the Pacific coast, at the same time the population dwindled and the economy was depressed in regions along the coast of the Japan Sea, the so-called "shortcoming of being overly dense and overly sparse". He proposed building a new national trunk railway, freeways, and communications networks as the driving force, implementing a new distribution of industry, renovating the production structure and regional structure, and establishing a regional society in which industry, culture and nature are coordinated, to create a new Japan. In the book, he presented an overall consideration of and combined the strategic goals for the economy, society and the environment.

9119
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IMPORTANCE OF ENVIRONMENTAL STATISTICS IN ECONOMIC, ENVIRONMENTAL MANAGEMENT DISCUSSED

Beijing HUANJING BAOHU /ENVIRONMENTAL PROTECTION/ in Chinese, No 11, 1982 pp 6-7

/Article by the Environmental Protection Bureau of Nantong City: "How We Developed Environmental Statistics"/

/Text/ Nantong began compiling environmental statistics in 1980. After more than 2 years of hard work, the city's environmental statistical work has got onto the right track, and has begun to find its way. All units, from the basic level units, and supervisory bureaus to the city's environmental protection bureaus, have established environmental files, have a better understanding of the city's environmental condition and have provided a basis for developing the city's environmental work.

To do this work well, we implemented the following four methods:

I. We improved understanding and unified planning.

When we compiled the first environmental statistics in 1980, many comrades had a vague understanding of the subject. For example, some assumed that the higher authorities wanted figures, and the task could be done simply by compiling a few numbers, and reporting them. Some said environmental statistics meant adding estimates to statistics, and figures need not be exact, the accuracy of the figures was not emphasized. Some proceeded from the partial and local interests of the small units, and worried that if the pollution figures were too large, they would have to pay more discharge fees and the units would "suffer a loss". There were also some units that only had part-time environmental protection personnel, their work load was heavy and their schedule was tight. They regarded environmental statistical work as an "extra burden" and feared the work. To counter this misunderstanding, we held a special environmental statistics meeting when planning environmental statistical work for 1981. At the meeting, we asked the leading comrades of the statistical bureau to convey the directives of the leading comrades of the central authorities concerning statistical work, we propagandized the importance of statistical work, and introduced the present situation of statistical work in China. Our bureau gave a report on compiling the city's environmental statistics for 1980 at the meeting, planned the tasks of compiling statistical reports and tables

for 1981, proposed concrete demands, and analyzed the favorable conditions to do statistical work well. After the meeting, everyone realized that environmental statistical work was the foundation of environmental protection work. Doing environmental statistical work well will not only provide truly reliable data for establishing the principles and policies of environmental protection work, treatment measures and environmental management, it is also closely related to improving the management level of enterprises and economic benefits. Doing environmental statistics well is a necessary condition to establish environmental management and management of enterprises on a scientific foundation. On the basis of improving understanding, we planned the tasks of compiling statistical reports and tables for 1981, unified the computational method and the specifications, and proposed clear demands: (A) We must truthfully reflect the environmental situation of one's own unit, we should not falsify or deliberately omit figures because of discharge fees. In the future, statistical figures should be used as reference when the city environmental protection bureau invests in treatment projects of basic level units. (B) We must truthfully report to the leadership, ask the leadership to review the report, and when necessary, explain the sources of the figures to the leadership. The report will only be valid for submission to the higher authorities after the leadership has signed it. (C) Each system must make plans on time, and submit reports on time. (D) Reports must be filled out conscientiously, and accurately. The draft tables must be filled out first. After the system has reviewed them, the final figures should then be filled in the original report in triple copies. The units, the supervising bureaus, and the city environmental protection bureau should each receive one copy to be included in the environmental files to guarantee the continuity of past environmental data.

II. We stressed the key points and provided guidance in time.

The units and power plants of Nantong's six industrial systems are the major polluting sources. The amount of sewage released by these units accounts for 83 percent of the total amount of sewage released throughout the city. The quality of their reports greatly affects the quality of environmental statistics of the entire city. Therefore, we viewed these units as the key points, we sent special persons to participate in basic level report planning meetings of these systems, repeatedly propagandized the importance of statistical work, explained the meaning of the goals in detail, unified the method of computation, patiently answered questions posed by the basic level units, used these meetings, as a substitute for trainig, and helped key units train a group of environmental statisticians. These comrades grasped a definite amount of special knowledge in environmental statistical work, and played an important role in statistical work.

III. We conscientiously reviewed the reports and checked each step.

To guarantee the accuracy of environmental statistics, each supervisory bureau and city environmental protection bureau conscientiously reviewed the reports and tables of the basic levels. The reports were centrally reviewed and individually reviewed. The reports were reviewed unit by unit, item by item, and problems that were discovered were corrected in time. Besides concentrating

and reviewing the six industrial systems, we also reviewed the general reports of the supervisory departments and the reports of basic level units of the financial, building materials, grain, traffic and health sectors one by one. When there were questions, we made inquiries. For example, when the gap between water consumption and the amount of sewage discharged by cement plants and brick and tile plants of the building materials system and the slaughtering and meat packaging plants of the commercial system was too large, the reason was clarified after asking questions.

IV. Data was categorized and summarized for ease of analysis.

To facilitate analytical study, the application of statistical results, and to understand the environmental situation in each industry, we categorized and summarized the data. Categorization and summarization involved dividing the reports by each system and units directly subordinate into two categories under the headings of industry and sanitation. The industrial category was further divided into four subcategories: (1) the six major industrial systems; (2) power plants; (3) traffic, finance and trade, building materials, grain, commercial systems and units directly subordinate, totaling eight sectors; (4) neighborhood offices in city wards and school-run industrial companies. The data on suburban commune-operated enterprises were summarized independently. Then, a table of contents was compiled and the statistics were combined into a book. In this way, the information could be more easily kept and used. For 2 years, the city's environmental statistics have played a preliminary role in economic construction and in environmental management, mainly manifested in the following:

A. The environmental statistics were used in national economic construction. The environmental protection tasks were assigned to each system and basic level unit in the form of figures. This year, the city government issued five goals for guaranteeing environmental protection. They required that 60 percent of the sewage be subjected to primary treatment. Based on this task and the statistical figures reported by each system, we assigned the 60 percent goal to each system. Each system in turn assigned this goal to the basic level units. In this way, we realized "guaranteeing work at the three levels" like other national economic goals. At the same time, we also proposed reducing the rate of discharge and the economic coefficient of release (ton/10,000 yuan of output value). If we did not have environmental statistics, it would not be possible to do this in such detail.

B. We provided a reliable basis for environmental treatment and environmental management. Most of the city's factories are in the suburbs. To change the release of sewage into the small rivers and to solve the problem of the effect upon water for agricultural use, we drew up plans to build several sewers to release the sewage in a concentrated way. The funds for building the pipelines shall be borne partly by the factories. The share of the cost to be borne was determined by the amount of sewage discharged by each factory listed in their reports.

C. We enabled basic level units to better understand their own environmental situation, established environmental files, and promoted management of

enterprises. The factories in the city's neighboring suburbs generally provided water for use by production teams without compensation. Every factory has at least two faucets. Because there was no means of measuring, the volume of water used for production and the volume of water for domestic use could not be separated, and in the course of compiling statistics, the factories gained an understanding of this problem and were prompted to emphasize the work of measuring the use of water. The factories installed water meters at each production section and department. In this way, resources were conserved, environmental pollution was reduced, and the quality of statistical figures improved.

D. To understand and analyze the change in environmental pollution in the city, grasp environmental trends, and improve the standard of environmental management, we began compiling environmental statistics into books starting this year. In this way, it was easy for the leadership to grasp the information and it was easy to carry out management. It also helped future analysis and comparison. All problems were explained in figures, monitoring of figures was implemented, the level of environmental management was improved and the development of environmental protection work was promoted.

E. To establish a good foundation for the goals of environmental protection plans in Nantong, we must include environmental protection in national economic plans, and form a system of planned goals. We have realized that environmental statistics are basic work. Without reliable figures, it would not be possible to propose various planned goals for environmental protection, including environmental protection in plans could only be an empty slogan. Although the roles of environmental statistics in economic construction and environmental management is only preliminary, practice proves that it is an essential task. It is an important and indispensable link in economic management and environmental management.

9296
CSO: 5000/4133

BETTER UTILIZATION OF RESOURCES KEY TO POLLUTION CONTROL

Beijing RENMIN RIBAO in Chinese 24 Jan 83 p 5

[Article by Wang Dengsan [3769 4098 0005]: "Pollution Control and Utilization of Material Resources"]

[Text] The serious environmental pollution in China and the necessity to control the "three wastes" of industry are understood more by many people now. But the work of protecting the environment has not been well-developed, environmental pollution has not been effectively controlled. There are many reasons. One important reason is that many people regard the control of pollution as simply treating the "three wastes," and regard it as an extra burden that is an expense without benefit. They do not see that the control of pollution can be combined with the better utilization of resources. Although controlling pollution requires spending some money, if it can be combined with the comprehensive utilization of resources, it can serve the two-fold purpose of controlling the "three wastes" and increasing profits.

In the process of industrial production, a part of the raw material is converted to products, and a part of the raw material becomes waste which is released into the surrounding environment as sewage, waste gases and waste slag (commonly called the "three wastes") and are the major sources of pollution at present. Our industrial production is somewhat backward, the waste of raw materials is astounding, the level of comprehensive utilization is low. Many resources that should be recovered and recycled for use become pollutants. According to a survey of more than 200 enterprises in 6 professions, including medicine, farm chemicals, and dyes, conducted by the Ministry of Chemical Industry, only one-third of the raw materials used in the production process is truly converted to products, the remaining two-thirds become the "three wastes" and are released into the environment. The paper manufacturing industry uses more than 800,000 tons of caustic soda each year, the amount recovered and utilized is less than 200,000 tons, the remainder is released with sewage which pollutes the water and endangers fishery. In foreign nations, over 90 percent of the caustic soda used to manufacture paper is recovered and utilized. This shows that the amount of the "three wastes" released is large, and is a serious waste of resources that are not well utilized.

For a long time, China's enterprises expanded reproduction under an equipment and management system that "copied the old ways and froze technical progress." Frequently, backward equipment is added on the foundation of backward technology to produce backward products, creating a vicious cycle of backward technology and equipment--high consumption--serious pollution --backward technology and equipment again--continued high consumption-- expanded environmental pollution. The nation's environmental pollution is serious. Since it is created by the irrational use of resources and energy and especially waste, we must concentrate on this fundamental problem. We must shift our major effort from releasing the "three wastes" to the production process that produces the "three wastes."

First, we must eliminate the "three wastes" during the course of production to the maximum extent through technical improvement.

One method is to reform backward technological processes and flow and substitute them with advanced technological processes that have a high rate of utilization of resources and good economic results so that primary resources can be converted to products to the greatest extent while discharging pollutants to the minimum. For example, the Nanjing Chemical Plant used the backward technology of the 1930s to produce aniline from nitrobenzene iron powder. The conversion rate was low, each year it released 9,000 tons of iron slurry containing aniline and 20,000 tons of sewage containing aniline. Pollution was serious. At one time, the percentage of illness among workers reached 60 percent. In 1978, that plant invested 1.8 million yuan to rebuild the backward technology into a new technology possessing the standards of the 1970s. Productive capability increased nearly onefold. Profits increased 1 million yuan within 1 year, and in less than 2 years, all the investment in this renovation was recovered. At the same time, the extremely toxic iron slurry containing aniline was eliminated. The amount of sewage containing aniline was reduced 60 percent, attaining the state's effluent standards. The various technical and economic indices reached advanced international standards, and in 1979, the plant was awarded the national gold medal.

The second method is to use new types of equipment that do not pollute, that pollute less and that conserve resources and energy to replace seriously polluting, obsolete equipment that waste resources and energy. For example, there are 200,000 old fashioned boilers that consume a large amount of energy throughout the nation. If they are gradually rebuilt, eliminated and replaced by new types of boilers, then calculating at an increase of 10 percent in thermal efficiency per unit, 30 million tons of coal can be conserved each year, and more than 700,000 tons of sulfur dioxide less will be released into the atmosphere. The cost will require a total investment of 2 billion yuan, which can be completely recovered in 2 years. If we build a coal mine of 3 million tons, the investment in capital construction alone will require 5 billion yuan.

The third method is to replace extremely toxic and severely harmful raw materials with non-toxic and harmless or less toxic and less harmful raw materials through renovating industrial equipment so that the irrational

product structure can be renovated and new products that do not pollute the environment or pollute the environment less can be developed.

Now, electroplating factories and shops are scattered throughout urban and rural areas, damage to the environment is severe. Besides readjusting, combining, and reorganizing enterprises to reduce the number of plants and shops, we should also select harmless raw materials. At present, the light industry and machinery departments are actively popularizing cyanogen-free electroplating to replace cyanogen electroplating, and have reduced environmental pollution. The chemical industry is actively developing and producing highly efficient pesticides with low residual toxicity to gradually eliminate pesticides that contain organic chlorine and have a high residual toxicity. This will solve the nation's pollution over a large area.

Practice proves that advanced technology, techniques and equipment are the material conditions to improve economic benefits and the environment. But whether the role of these conditions can be fully developed is determined by the level of scientific management of the enterprises. According to survey and analysis, at present, the amount of wasted resources and energy due to poor management throughout the nation accounts for about 25 to 30 percent of the total amount of the "three wastes."

Second, we should develop comprehensive utilization on a large scale, carry out total processing to change the "three wastes" into resources.

Comprehensively utilizing the "three wastes" to the maximum extent is a way to create wealth by developing the potential of the internal resources of industrial enterprises, and it is also an effective way for enterprises to become self reliant, to control pollution and to improve the environment. There are many ways to realize comprehensive utilization. The major methods of many industrial and mining enterprises are as follows: (1) fully recovering and utilizing surplus heat and combustible gases; (2) separating the flow of clean water and sewage, using closed loop recycling, using one source of water for many uses, improving the rate of recycled utilization of water, and reducing the amount of industrial sewage released; (3) separating and retrieving useful materials from the "three wastes," or carrying out total processing so that abandoned materials and garbage are converted into new products; (4) all resources of the "three wastes" which cannot be comprehensively utilized by an enterprise itself should break through the boundaries of their industries and should be actively used by other plants so that the "three wastes" of one factory can become the raw material of another factory. The results of these methods have been very good. According to statistics of the metallurgical system, each year, over 2.5 million tons of iron slurry are recovered from sintering and iron and steel smelting, equivalent to the annual productive capability of a medium sized mine. Each year, steel and iron slag of more than 12 million tons are utilized. Over half of the total output of cement throughout the nation is high grade cement produced by using water slag from blast furnaces. The amount of combustible gases recovered from blast furnaces, coking furnaces, oxygen top blown rotary furnaces reaches more than 53 billion cubic meters, equivalent to nearly 10 million tons of standard coal. The nonferrous metals enterprises

are using smelting smoke to produce more than 900,000 tons of sulfuric acid, constituting 12 percent of the total output of sulfuric acid throughout the nation, and each year, 50,000 tons of nonferrous metals and rare and precious metals are recovered from the "three wastes" of the nonferrous metals industry.

China has a great potential to develop comprehensive utilization. According to the 1981 statistics of the environmental protection department, 42 million tons of materials are released into the atmosphere along with waste gases each year. This includes 14 million tons of sulfur dioxide, equivalent to 7 million tons of sulfur. The recovery of sulfur to manufacture sulfuric acid is more convenient than extracting sulfuric acid from ferrosulfide ore, and this also greatly reduces the amount of sulfur dioxide released into the atmosphere. This is the fundamental way to solve air pollution. Also, the nation has a serious shortage of caustic soda. Over the years, several hundred thousands tons have been imported. It is entirely possible to increase the rate of recovery and utilization of caustic soda in the paper manufacturing industry from the present 25 percent to 60 to 70 percent. In this way, 400,000 to 500,000 tons of caustic soda can be retrieved a year. This not only can greatly solve the shortage of caustic soda and the problem of serious pollution of the environment caused by the paper manufacturing industry, it can also solve the long-standing, big and difficult problem debated for many years concerning the effect of terminating the production of the pesticide "BHC" on the production of caustic soda. It can serve to solve three problems with one effort.

9296
CSO: 5000/4125

BRIEFS

SCIENTISTS' POLLUTION CONTROL PROPOSAL--Hangzhou, 19 Mar (OANA/XINHUA)--Establishing a National Environmental Protection Research Center and inspection centers were proposed by scientists attending a 7-day national forum on air pollution and its control. At present, they said, efforts should be concentrated on improving the air quality of the municipalities of Beijing, Tianjin and Shanghai, and the provinces of Liaoning and Shanxi. Liaoning is one of China's leading heavy industrial centers and Shanxi, China's biggest coal producing province. Air quality surveys have been completed in Beijing, Tianjin, Shanghai and Liaoning, the forum reported. Scientists proposed that the same surveys should be made in all provincial capitals. Increased supply of low-sulphur coal is another method proposed by scientists to help improve air quality. High-sulphur coal, they said, emits in the course of burning too much sulphur dioxide, which is foul and harmful to people's health. The forum, which was held in Hangzhou, capital of Zhejiang Province, ended yesterday. [Text] [Beijing XINHUA in English 0704 GMT 19 Mar 83 OW]

CSO: 5000/4167

BEIJING CONTINUING ANTIPOLLUTION MEASURES

OW200416 Beijing XINHUA in English 0204 GMT 20 May 83

[Text] Beijing, 20 May (XINHUA)--Beijing's Capital Iron and Steel Company, which has been a major source of pollution since it was set up in 1919, now looks more like a botanical garden.

The 110,000-employee complex boasts a rose garden of 15,000 square meters, 2,800 large and small flower beds with thousands of blooming flowers and green cover of trees, grass or flowers over 96.4 percent of the company's open space.

"This doesn't mean the plant is really pollution free," said Jiang Xiaoke, chief of the city's environmental protection bureau, "but it's a good example of the attention and effort being paid to the problem."

She said that Beijing's fast-growing industries and population have caused air, water and noise pollution. However, the city government in the past few years has made a huge effort to get the problem under control.

According to Jiang, the air pollution, the city's most serious type, is mainly caused by burning coal for cooking and heating in winter and [sic; "...is normally cleared out by..."?] the strong winds in spring. In 1981 Beijing residents and factories burned 15 million tons of coal, which produced 260,000 tons of sulphur dioxide and 420,000 tons of soot particles.

To tackle the problem, the city decided to shift to gas or liquefied petroleum gas for cooking. By the end of last year, 800,000 households, or 70 percent of the urban total were using the new fuels.

At the same time, 90 percent of the 12,000 boilers for winter heating had been technically improved to raise efficiency and reduce smoke, and soot removers were installed on 50 percent of them.

This year, Beijing plans to plant 700,000 trees and 200 hectares of grass, bringing the city's green cover to 3,000 hectares, or 22 percent of its total open space.

Water contamination, the bureau chief said, results from industrial and domestic sewage. Each day, about 2 million cubic meters of sewage go into the rivers flowing through the city.

In the next 3 years, the city plans to dredge three of its main rivers and lay more sewage pipes, thus turning the polluted rivers into clear waterways. So far the dredging of the northern city moat has been completed and two other dredging projects are under way.

Jiang Xiaoke also said the major noise pollution sources are factory machines and vehicle klaxons. On 25 April, the last foundry in the central city was moved out. The 62 square kilometers of central Beijing has no foundry or forging shop.

An official of the city's public security bureau said, they have difficulties in banning horns at present. "For the time being," he said, "we have decided to ask owners of vehicles to replace their present horns with low-frequency ones." He said 80 percent of the vehicles in the city are now using horns of under 105 decibels.

Beijing has also set up a research institute and an environmental monitoring center with a staff of over 300, Jiang said. The city government has issued six regulations on environmental protection and more are expected to be promulgated in the next few months.

"We'll try to put our work on a more scientific basis and try to build the capital into a beautiful garden, even better than what the Capital Iron and Steel Company is today," Jiang said.

CSO: 5000/4167

THREAT OF FINES ENCOURAGES ENVIRONMENTAL IMPROVEMENTS

Lanzhou GANSU RIBAO in Chinese 12 Feb 83 p 2

/Article by Kuang Lei /0562 4320/: "Handle Affairs According To the Law, Promote Treatment by Management, Gansu Uses Economic Measures to Protect the Environment"/

/Text/ At the end of 1982, 43 counties (districts) in 12 areas, prefectures, and cities collected fees from approximately 550 waste discharging units for exceeding the effluent standards. A new phase of conscientiously implementing regulations on environmental protection and using economic measures to manage the environment has emerged.

Last year, the State Council promulgated the "Provisional Measures for Levying Pollution Charges". This is an important regulation and policy set by the government concerning environmental protection and pollution prevention. Compared to the effluent fee method practiced in Gansu, this measure has a much wider range, more items, higher standards, a heavier work load and the policy is strong. Therefore, departments concerned have individually held special meetings to discuss and implement ideas, draw up clear plans for the work, and smoothly realized the transition and readjustment of the fee collection method.

Implementing effluent fees has promoted environmental management, has saved a large amount of natural resources and energy, and has controlled or reduced pollution. For example, the Lan Hua Company has implemented an internal economic administration method to strictly control effluent discharge, and has saved 1.84 million tons of water a year, has reduced chemical discharge by 1 million tons, and various toxic and hazardous substances by more than 16,000 tons. Second, it has brought about technical improvements, comprehensive utilization and treatment techniques have been improved. For example, the Baiyin Company retrieved tail gas consisting of sulphur dioxide, converted the sulphur dioxide into liquid form, and proved it to be successful in fueling vehicles. The amount of sulphur dioxide in tail gas was reduced from 288 kilograms per hour to 19 kilograms per hour, a new product was produced and pollution was eliminated. Third, it has accelerated the normal operation of environmental protection treatment facilities. Because the treatment of electroplating effluent at the Tianshuihongshan Experimental Machine Plant did not meet the standards for 1 day, the leaders of the plant and workshop,

and the persons involved were fined the month's 40 yuan bonus. This event had great impact; now, the electroplating effluent treatment facilities at Tianshui are maintained and used, and plant meets the effluent standards. Fourth, it has created a means of revenue. Since 1980, the province has used 5.98 million yuan, collected from effluent fees, to supplement more than 60 environmental protection projects, and has aroused the enthusiasm of discharge units to treat pollutants.

12365
CSO: 5000/4149

SHANGHAI TO SET UP UNDP-FINANCED WASTE PROJECT

OW141125 Beijing XINHUA in English 0732 GMT 14 May 83

[Text] Shanghai, 14 May (XINHUA)--A demonstration project financed by the United Nations Development Program (UNDP) will be set up in Shanghai, China's largest city, to improve methods for recycling of waste materials.

The co-project is designed to recycle used rare metals, plastics, paper and other wastes. It will import advanced foreign equipment and technology and help train personnel, both Chinese and foreign from other developing countries.

Shanghai has reached a high standard in waste collection and recycling. In the past 26 years between 1957 and 1982, the Shanghai Materials Recovery and Utilization Company had recovered 21.9 million tons of waste materials including rare metals, paper and plastics, valued at more than 4.45 billion yuan.

A group of experts in waste recovery and utilization, environmental protection and sanitation from Shanghai are now on a study tour abroad.

CSO: 5000/4167

BRIEFS

LIAONING POLLUTION-CONTROL ACHIEVEMENTS--Over the past 1 year, Dalian City, Liaoning Province, has completed the building of 26 projects for controlling pollution. Thus, the city has disposed of over 950,000 tons of polluted water; over 440 million cubic meters of waste gas; over 5,200 tons of powder dust; and disposed of 70,000 tons of waste residues. [Shenyang LIAONING RIBAO in Chinese 3 Mar 83 p 1 SK]

JAPANESE ENVIRONMENTAL PROTECTION GROUP--The environmental protection delegation from (Zhenhe) County, Japan, headed by (Liuyuan Zhengdian) arrived at Changsha yesterday morning for a visit at the invitation of the Hunan branch of the Chinese People's Association for Friendship with Foreign Countries and the Hunan Provincial Construction Committee. The delegation has nine members. They will focus on making on-the-spot investigation of the province's education and scientific research related to environmental protection, the pollution caused by industry and agriculture and the processing and management of domestic sewage. Yesterday evening, Sun Guozhi, vice governor, and Wan Da, chairman of the Provincial People's Congress Standing Committee, and other responsible persons of the relevant provincial departments met all members of the delegation in Rong Garden. After they met, the Japanese friends gave a show of the television newsreel about Sun Guozhi and Wan Da visiting (Zhenhe) County and signing a friendship agreement there. [Text] [HK190341 Changsha Hunan Provincial Service in Mandarin 2310 GMT 18 Apr 83]

CSO: 5000/4168

PRC MINISTER EXPLAINS MARINE ENVIRONMENTAL LAW

HK180420 Beijing GUANGMING RIBAO in Chinese 7 Mar 83 p 4

[Report: "Li Ximing, minister of urban and rural construction and environmental protection, answers GUANGMING RIBAO reporter's questions on implementation of the laws for the protection of marine environment"]

[Text] Question: Can you discuss the purpose of enacting the marine environmental protection law?

Answer: This needs to be discussed from the viewpoint of our marine conditions and the role of seas and oceans in the national economy.

Ours is a continental country as well as an oceanic country. We have a vast sea area and a coastline 32,000 kilometers long, of which, the mainland coastline is more than 18,000 kilometers. There are many fine harbors along the coast. Our conditions for marine transportation are very good. We also have many beaches which may be reclaimed or be used for aquatic breeding. There are abundant marine biological resources on the vast continental shelf. We have 1.5 million square-kilometers of sea fishing ground in which there are more than 1,500 kinds of fish, shrimp, prawn and lobster which have high economic value. Our seabed has rich mineral resources, and we have begun to develop offshore petroleum. All this shows that the seas and oceans hold an important position in the national economy. It is expected that the development and utilization of the seas and oceans will speed up along with the development of the national economy. In particular, the development of the offshore petroleum industry and the increase in domestic and foreign vessels appearing in our territorial waters with increased volume of international trade will cause pollution to our marine environment. In addition, our industry is mainly concentrated in coastal areas. In the future, pollutants discharged from land to sea will continue to increase. Thus, we are faced with a task of protecting our marine environment. The purpose of formulating and implementing the marine environmental protection law is to control marine pollution, maintain the marine ecological balance and promote the development of various marine undertakings.

Question: How serious is our present marine pollution? What have we done to protect the marine environment? What results have been achieved?

Answer: The environment in our waters is basically good. At present, pollution is mainly caused by marine transportation and pollutants discharged from land. Some coastal sea areas, especially, some estuaries, harbors and inland seas have been seriously polluted. Because of marine pollution, some fishing grounds have had to be moved further offshore; shoals of fish have been found dead; some coastal aquatic farms have become desolate; and some valuable aquatic resources have been destroyed.

In recent years, we have done some work in protecting the marine environment. In 1977, the State Council approved the founding of a leading group in charge of environmental protection in the Bohai and Huanghai Seas. The group has led the work of controlling pollutant sources along the coast. The harbor administration departments have also done a great deal of work to control and oversee the pollutants discharged by vessels. At present, the pollution caused by petroleum and heavy metals in these sea areas has been reduced. We have also organized large groups of research personnel to conduct comprehensive studies concerning the prevention and control of pollution in the Bohai and Huanghai Seas and these researches have achieved initial results. Furthermore, the National Bureau of Oceanography and the authorities concerned in coastal provinces, municipalities and autonomous regions have made surveys of environmental conditions in the Bohai, Huanghai, Donghai and Nanhai Seas and have carried out some pollution monitoring work. All this has provided a scientific basis for giving further protection to the marine environment and strengthening the management of the marine environment.

Question: In order to protect the marine environment, what pollutants should we bring under control at present?

Answer: The Marine Environmental Protection Law has laid down legal definitions on a few factors which may lead to marine pollution. At present, oil pollution is ranked first among various kinds of marine pollution. Oil pollution is mainly caused by a number of coastal land oilfields and oil tankers transporting oil at sea. Some accidents, in which oil is spilled, may cause serious marine pollution. Pollution accidents of this kind have arisen in the world on many occasions. Therefore, all nations in the world have paid special attention to oil pollution. The third chapter of our Marine Environmental Protection Law specially stipulates a series of rules to prevent the marine environment from becoming polluted by the exploitation of offshore petroleum. The state department in charge of offshore petroleum development has attached great importance to these measures.

With the development of marine transportation business, the amount of oil transported by sea will certainly increase. Strengthening management over shipping is an important field in protecting the marine environment. The fifth chapter of the Marine Environmental Protection Law includes stipulations for preventing ships from spoiling the marine environment.

In addition, the Marine Environmental Protection Law also includes stipulations on controlling possible pollution by coastal construction projects and other pollutant sources on land.

Question: How can we do a good job in protecting the marine environment?

Answer: The work of protecting the marine environment involves a wide sphere. It is very difficult for any single department to handle this work independently. Therefore, the Marine Environmental Protection Law, based on the principle of sharing responsibility among all departments concerned, stipulates that this work should be handled jointly by a number of departments concerned. The Ministry of Urban and Rural Construction and Environmental Protection takes main responsibility for marine environmental protection work throughout the country. The Marine Environmental Protection Law also designates the duties to be borne by the State Oceanography Bureau, the State Harbor Superintendency Administration, the State Superintendency Administration for Fishery and Fishing Ports, the army's environmental protection department, and the environmental protection departments in coastal provinces, municipalities and autonomous regions.

The division of responsibility among these departments has two characteristics: 1) responsibility is divided based on sources of pollution or spoilage on the marine environment, and not according to geographical regions; 2) both state and local environmental protection departments have the duty to organize, coordinate, supervise and inspect marine environmental protection work. This method of responsibility division and stipulations is based on our nation's special conditions. At the same time, they will be helpful in the implementation of the law and the work of managing the marine environment.

Question: How should acts in violation of the law be dealt with?

Answer: The stipulations concerning this question can be found in the chapter dealing with legal responsibility. Violators of the law who cause pollution and damage to the marine environment will be made to bear responsibility for compensation, accept administrative disciplinary measures, or take criminal liability according to the seriousness of their cases.

The Marine Environmental Protection Law also clearly stipulates that units or individuals being harmed by pollution have the right to enter suit in a people's court or lodge complaints with administrative departments in charge. According to the stipulations, both sides involved in a case have the right to appeal to a people's court according to the procedural law of civil actions if any one of them refuses to accept the decision made by the administrative department in charge.

Question: The marine issue is one concerning the international community. What position does our state take with regard to marine environmental protection?

Answer: There are more than 130 oceanic countries in the world. Protecting the marine environment is an important global issue concerning the interests of many countries. At present, countries throughout the world have attached importance to protecting marine environment. A number of international organizations have been founded and a number of international conventions have been formulated for this purpose. Under the present conditions, it is necessary for all nations to undertake joint efforts in order to effectively protect the marine environment throughout the world. By strictly implementing the Marine Environmental Protection Law, our nation will make contributions to mankind in the field of protecting the marine environment.

CSO: 5000/4168

PRC IMPLEMENTS MARINE ENVIRONMENTAL PROTECTION LAW

Effective 1 March

OW282102 Beijing XINHUA Domestic Service, 28 Feb 83

[By correspondent Tan Zheng]

[Text] Beijing, 28 Feb (XINHUA) -- "The Marine Environmental Protection Law of the PRC" comes into effect on 1 March. This law was adopted at the 24th Session of the 5th NPC Standing Committee on 23 August 1982. To protect the seas and oceans against pollution and damage, the Marine Environmental Protection Law has provided legal stipulations in five areas:

1. Protect the marine environment against pollution and damage by coastal projects;

2. Protect the marine environment against pollution and damage by offshore petroleum exploration;

3. Protect the marine environment against pollution and damage by land-originated pollutants;

4. Protect the marine environment against pollution and damage by boats and ships; and

5. Protect the marine environment against pollution and damage by the dumping of wastes.

In addition, the Marine Environmental Protection Law has also set down unequivocal regulations concerning the administrative compensation and criminal responsibilities regarding any violations of this law.

"The Marine Environmental Protection Law of the PRC" is the first formal law of its kind ever published by China for managing its marine environment. Its implementation signifies that China has begun an era of managing its marine environment with a legal system. This is of great importance in strengthening the environmental management of coastal industrial and mining enterprises and offshore petroleum exploration and waste dumping; preventing and controlling marine undertakings and safeguarding state rights and interests.

Oceanography Chief on New Law

HK270224 Beijing CHINA DAILY in English 27 Feb 83 p 1

[Report by staff reporter: "Legislation To Protect Marine Environment"]

[Text] The purpose of the Marine Environmental Law, which comes into force on March 1, is for us to use marine resources more profitably and to adapt our various economic activities to marine ecological laws, said Luo Yuru, director of the National Bureau of Oceanography.

It does not aim to restrict normal economic activities in an aimless way, Luo told CHINA DAILY.

China has coastline more than 18,000 kilometres and vast territorial waters with abundant marine resources. With the growth of industries and agriculture along the coastal regions, sewage is discharged into the seas untreated, causing pollution to estuaries, harbors and the seas as well as damage to marine resources, Luo said.

A marine environmental law becomes all the more necessary as more and more foreign vessels, aircraft and development companies appear in our territorial waters with increased volume of trade and international interflow, Luo said.

Violators of the law will be made to remedy the pollution within a specific time, pay a pollution discharge fee, defray the expenses for pollution removal and compensate for the damage sustained by the state. Warnings will also be served and fines imposed on them, Luo said.

Luo said in serious cases involving great losses to public or private property or even casualties, criminal liability may be apportioned to these responsible according to the law.

This is applicable to all foreign vessels and companies within China's territorial waters. So all foreign vessels, aircraft, platforms and development companies that enter China's territorial waters should observe the Marine Environmental Protection Law, Luo said.

The Ministry of Urban and Rural Construction and Environmental Protection is in all-around charge of marine environmental protection work, with the National Bureau of Oceanography responsible for scientific research and the prevention of pollution caused by offshore oil exploitation in offshore areas. Harbor and fishery departments, Army units and coastal regions each take care of environmental protection of the areas in their own charge, Luo said.

Personnel are being trained and more vessels, equipment and instruments will be allocated for effective implementation of the law, Luo said.

Sea Patrols Set To Enforce Law

OW011141 Beijing XINHUA in English 1211 GMT 28 Feb 83

[Text] Beijing, February 28 (XINHUA Correspondent Yu Yuanjing) -- Three vessels based in Qingdao, Shanghai and Guangzhou will begin patrolling sea areas under China's judrisdiction tomorrow, the day when China's new Marine Environmental Protection Law goes into effect, to watch out for pollution of marine resources. Yan Hongmo, deputy director of the State Bureau of Oceanography, said this is an interview today.

The "Marine Environmental Protection Law of the People's Republic of China" was adopted last August. As one of the Chinese institutes to enforce it, the deputy director said, his bureau "intends to strictly implement this law" through regular and irregular patrols by monitoring vessels for surveillance in sea areas under China's jurisdiction.

Called "Zhongguo haijian" or China's marine surveillance ships, these ships have the right to report violations to the appropriate authorities of the Chinese Government or to warn, fine, claim damages on the spot. They may also investigate and affix responsibility for crimes of those domestic or foreign vessels, platforms, airborne vehicles, submersibles, or enterprises, institutions and individuals that are found discharging harmful matter or dumping wastes which cause or are likely to cause pollution damage to the Chinese sea areas. They will also monitor pollution in the Chinese sea areas.

China has vast sea areas and numerous islands, Yan Hongmo said. It is important to the country's modernization drive to properly exploit and utilize the marine resources and protect the marine environment. However, China's marine environment has been polluted in varying degrees in recent years. In some areas such as rivers' mouths, harbors and bays, environmental pollution and damage to marine resources have been quite serious.

On the other hand, Yan Hongmo said, with the development of the country's foreign trade and external economic cooperation, more and more foreign ships, aircraft and development corporations are entering sea areas under China's jurisdiction. This also calls for strengthened surveillance and management in this field. "It was to deal with such a situation that China has formulated the Marine Environmental Protection Law," the deputy director said. "The aim is to bring people's economic activities into conformity with marine ecological balance so as to better utilize the marine resources."

In conclusion, Deputy Director Yan expressed his hopes that foreign ships, platforms and corporations including Chinese-foreign joint ventures that enter or operate in Chinese sea areas would consciously abide by the Marine Environmental Protection Law of the People's Republic of China and cooperate with the Chinese law-enforcement institutes in the enforcement of the law.

Ocean Oil Pollution Controlled

OW262024 Beijing XINHUA in English 1508 GMT 26 Feb 83

[Text] Beijing, February 26 (XINHUA) -- China has by and large controlled oil pollution in the Bohai Sea and Yellow Sea off its northern coast, according to the State Bureau of Oceanography.

A recent survey provided the basic data for drawing up the Marine Environmental Protection Law of the People's Republic of China, which was adopted on August 23, 1982, by the 24th Meeting of the Standing Committee of the Fifth National People's Congress. The statute will go into effect March 1, 1983.

The bureau, together with departments concerned and the coastal provinces and municipalities, has launched a large-scale investigation of pollution in China's coastal waters since 1974. 4,700 monitoring stations have been set up. The subjects surveyed covered water quality, seabed constitution, concentration of heavy metals, oil and organic chlorine pesticides in bodies of marine life, and hydrological and meteorological factors over an area of 450,000 square kilometers. Altogether, tens of thousands of specimens were collected and more than one million pieces of data covered.

After completion of the overall investigation in 1978, the bureau began continuous monitoring of several major sea areas, including the off-shore areas surrounding the Bohai Sea and Yellow Sea, waters around the Tanhu Island in the East China Sea, the mouth of the Zhujiang (Pearl) River and off-shore areas of Guangdong Province in the South China Sea. The pollution situation and trends in these areas have now been surveyed. This study has provided important primary data for assessing environment quality and controlling pollution of the areas.

Pollution in the coastal area of Bohai Sea and Yellow Sea was once quite serious, the Bureau of Oceanography reported. In order to control the varied pollution in this area, the bureau organized nearby provinces and municipalities to set up a monitoring network. Constant, periodic monitoring indicated that the main pollutant in the area is oil, which comes from oil waste water discharged by ships and coastal refineries.

The State Council has organized coastal industrial and transport enterprises to control pollution in the sea area by transforming technological processes, establishing water-oil separating equipment and retrieving oil from waste water. The total volume of oil now discharged into Bohai Sea and Yellow Sea has been greatly reduced. The content of oil in the water of the area approaches national standards.

China has also recorded achievements in research of applied technology and basic theories in the area of marine conservation, such as capacity of the marine environment to purify itself and the extent to which pollution affects marine life. In the past several years, the State Bureau of Oceanography alone has conducted 45 research projects about marine conservation. To date, more than 60 research reports and papers have been compiled, some of which have already been put to practical use.

RENMIN RIBAO Assesses New Law

HK011250 Beijing RENMIN RIBAO in Chinese 1 Mar 83 p 2

[Commentator's article: "Strengthen the Legal System, Protect the Ocean"]

[Text] The PRC Marine Environmental Protection Law comes into force today. This is an important affair which marks the fact that China has started to manage its marine environment through legal means. It is of great significance in safeguarding the national rights, benefits and dignity, in controlling marine pollution and in protecting and developing marine resources, maintaining the marine ecological balance and promoting the development of various marine undertakings.

Our country has a vast sea area, a long coastline, a great number of islands and many densely packed harbors and bays. All this constitutes favorable conditions for marine transportation. On the vast continental shelf there are abundant marine biological resources due to the suitable water temperature. Along the coast there are many beaches which may be reclaimed or be used for breeding aquatic life. We are also rich in offshore petroleum resources which have high economic value and prospects for marine energy development are excellent. Therefore, rationally developing and utilizing our seas and oceans constitutes an important part of our task to quadruple the total annual industrial and agricultural output value by the end of this century.

At present our marine environment has been polluted and damaged in varying degrees. In some sea areas around estuaries, some harbors and bays, some inland seas and offshore areas, environmental pollution has become very serious. Residual poisons in bodies of marine life have steadily increased. Fishing grounds have to be moved further offshore. Red tides have appeared in a few bays. Some coastal aquatic farms have become desolate. Even some well-known coastal tourist resorts have also been polluted. Therefore, strengthening marine management and preventing marine pollution is an important task for developing our nation's marine undertakings.

The purpose of enforcing the Marine Environmental Protection Law is to protect marine environment against pollution and damage, and to maintain the marine ecological balance. To a certain degree, seas and oceans can play a role in purifying waste so it is allowed to discharge appropriate amount of waste into seas and oceans. But this must be brought under strict control. Acts leading to damage to the marine environment must be strictly banned so as to safeguard the overall and long-term interests of marine undertakings.

Prevention should be taken as the main measure for protecting the marine environment. Different from the land environment, once pollution is caused to the marine environment it is not easy to cure the damage in a short time, even if costly remedies are taken to stop the pollution. Therefore, the work of protecting the marine environment must adhere to the principle of putting prevention first. So long as all parties concerned attach importance to this issue and take effective measures to cope with it, it is possible to prevent the marine environment from pollution.

In order to protect the marine environment it is necessary to publicize the law among the masses and require them to abide by the law. The vast number of inhabitants, fishermen in coastal areas and departments whose work is related to the seas and oceans must all consciously abide by and safeguard the Marine Environmental Protection Law. With the law coming into effect we can supervise legally, deal with affairs according to law, enforce the law strictly and affix criminal responsibility for any violations of the law.

The seas and oceans constitute a problem for the whole world. Preventing the pollution of seas and oceans and protecting the marine environment is in the interest of all nations throughout the world. This international social issue calls for joint efforts by all nations. By earnestly implementing the Marine Environmental Protection Law, our nation will certainly make due contributions to mankind.

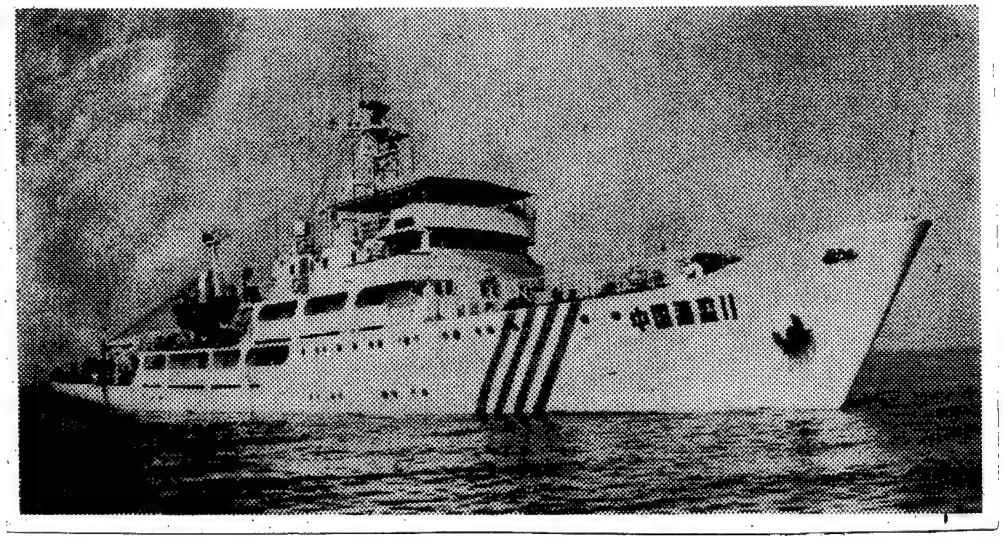
CSO: 5000/4170

PATROL BOATS DISPATCHED TO ENFORCE ENVIRONMENTAL PROTECTION LAW

Beijing RENMIN RIBAO in Chinese 1 Mar 83 p 3

[Text] In order to enforce the Marine Environmental Protection Law of the People's Republic of China, The State Oceanography Bureau has dispatched the environmental inspection vessel "Zhongguo Haijian 11" to conduct ocean inspections and to enforce the law in waters under Chinese jurisdiction in the Bohai and the Yellow Sea.

The "Zhongguo Haijian 11" is equipped with four laboratories, including labs for hydrology, chemistry, and biology and specialized instruments and equipment for environmental investigation and monitoring used to conduct marine environmental investigations and scientific research.



Law enforcement personnel of the "Zhongguo Haijian 11" closely monitor the marine environment.

CSO: 5000/4145

PATROL BOATS TO HELP IN ENFORCING ENVIRONMENTAL PROTECTION LAW

HK260436 Beijing ZHONGGUO XINWEN SHE in Chinese 1406 GMT 25 Feb 83

[Text] Shanghai, 25 Feb (ZHONGGUO XINWEN SHE)--In order to enforce the PRC Marine Environmental Protection Law, China's State Oceanography Bureau's Management Office for Marine Environmental Protection in the East Sea will dispatch a law enforcement ship, "No. 41 China Sea Watcher," to the East China Sea area to carry out supervision and management according to the law.

The vast area of China's East Sea is rich in all kinds of resources. Economic construction in coastal provinces and cities, together with various marine and maritime undertakings--including off-shore petroleum development, marine transportation, sea fishery, salt production, oceanographical research, and foreign exchanges--have all developed rapidly. However, at the same time, the quantity of harmful waste discharged into the sea is gradually increasing. Sewage discharged into the sea amounts to billions of tons a year. The marine environment has been polluted to varying degrees.

In order to prevent and control marine pollution, protect marine resources and safeguard our maritime rights and benefits, on 23 August 1982 the 24th Meeting of the 5th NPC Standing Committee adopted the PRC Marine Environmental Protection Law, to be put into effect on 1 March 1983. The enforcement of the law marks the fact that China has started to manage its marine environment through legal means.

CSO: 5000/4141

SHANDONG MAKES EFFORT TO CLEAN-UP MARINE ENVIRONMENT

Jinan DAZHONG RIBAO in Chinese 17 Mar 83 p 1

[Text] The Marine Environmental Protection Law of the People's Republic of China became officially effective on 1 March. The Deputy Governor of Shandong, Song Yimin, spoke on the subject last night (the 16th) on television.

He said that the implementation of the Marine Environmental Protection Law marked a new stage of legislation in China with respect to managing the marine environment, and will contribute to controlling marine pollution, protecting marine resources, maintaining the ecological balance of the oceans, and promoting the development of marine enterprises and the construction of the four modernizations.

He reviewed the work of protecting the marine environment in the province, saying that through the joint efforts of related local and municipal departments in the past several years, a good deal has been accomplished. At present, crude oil pollution of the Shandong section of the Bo Hai and the Yellow Sea is basically controlled. Large area oil slicks no longer occur in the Yellow Sea, and good results have also been obtained in the prevention and control of heavy metal pollution. Mercury, chromium, and cadmium concentrations of the water along the Shandong section of the Bo Hai and Yellow Sea all meet the state standards for sea water.

He pointed out that based on the requirements of the Marine Environmental Protection Law, the responsibility of the province is extremely heavy in preventing and controlling marine pollution. The province discharges about 900 million tons of industrial wastewater a year and most of it is directly or indirectly released into the Bo Hai and Yellow Sea. This wastewater contains such hazardous substances as petroleum, chlorides, etc., which pollutes the sea in varying degrees. Therefore, he demands that all related departments and industries of the cities and other localities cooperate closely to perform the following items through joint efforts:

(1) To study and give wide publicity to the Marine Environmental Protection Law, and continue to improve the understanding of all the people and cadres regarding the protection of the marine environment. The units of land-based pollution, coastal fishermen and inhabitants, and the departments related

to the sea should be educated so that everyone knows and understands it. The marine environment will become everybody's concern and all will work toward a new situation of protecting the marine environment.

(2) Prevention and control of the marine environment must be included in planning. The current source of marine pollution in the province is chiefly land-based. Based on the requirements of the Marine Environmental Protection Law, all cities, counties, and related departments should synchronize the local marine pollution prevention and control plan with the departmental development plan and carry them out together. In particular the various economic management and environmental protection departments should concentrate on managing the disposal of industrial wastes and comprehensive utilization based on related regulations of the State Council to prevent marine pollution.

(3) The management of the marine environment should be strengthened. Departments relating to coastal economic management, environmental protection, harbor affairs, harbor surveillance, fishery, oceanic navigation, export trade, and maritime safety should cooperate and work closely together to strengthen the management of harbors, wharves, coastal beaches and shoals, seashore construction, and land-based pollutants; strengthen the monitoring of the ocean, and strengthen the investigation and disposal of pollution incidents. The department of harbor affairs and monitoring should earnestly perform the work of monitoring the discharge of pollutants by foreign and domestic ships.

(4) The leadership of marine environment management work should be strengthened. Coastal cities and counties and concerned departments should place this task on the daily agenda, and emphasize it. The enthusiasm of all sectors should be mobilized, and the role of marine research units and universities should be fully developed to contribute to the protection and improvement of the marine environment.

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CSO: 5000/4153

SERIOUS WATER SHORTAGE CREATES NEED FOR STRONG CONSERVATION MEASURES

Beijing DILI ZHISHI /GEOGRAPHICAL KNOWLEDGE/ in Chinese, No 12, 1982 pp 2-3

/Article by Tang Qicheng /3282 1142 2052/: "On the Utilization of China's Water Resources"/

/Text/ China's water resources are not scarce in total amount. The average annual runoff of rivers is 2,600 billion cubic meters, ranking fifth in the world following Brazil, the Soviet Union, Canada, and the United States. Our groundwater resources amount to about 800 billion cubic meters. There is a definite conversion between surface water and groundwater. Therefore, a part of the volume of these two resources is repeated. After deducting the repeated quantity, the total volume of water resources averaged over many years throughout the nation is about 2,700 billion cubic meters. By population, the average per capita runoff in the nation is about 2,700 cubic meters, equivalent to only one-fourth the average per capita volume of runoff in the world. Therefore, China's water resources are not very abundant.

China's river runoff resources are very unevenly distributed in space and time. In regional distribution, each mu of cultivated land in the Chang Jiang river valley in the south has an average of 2,600 cubic meters of runoff. The per capita volume of runoff is 2,800 cubic meters. In the northern Hai He, Huang He and Huai He river valleys, the total average per capita volume of runoff is 480 cubic meters, about one-sixth that in the Chang Jiang river valley, but the average volume of runoff per mu of cultivated land is only 260 cubic meters, only one-tenth that of the Chang Jiang river valley. In time distribution, it is also very uneven. In most regions, the summer season is the flooding period, and can account for 50 percent of the volume of the annual runoff. Winter and spring are dry seasons, the volume of water visibly reduces and the rivers even dry up and stop flowing. The variation in the river runoff between years is also great, and consecutive years of abundant water and consecutive years of less water may occur.

The difference in regional distribution of groundwater resources is also very great. Some regions have a lot of water, some regions have little water, and some regions do not have any water.

The above are the basic characterisitcs of the quantity and distribution of China's water resources. Since the founding of the nation, great achievements

in the utilization of water resources have been realized. At present, the quantity of water resources used each year is about 460 billion cubic meters, constituting 17 percent of the total volume of water resources in normal years. The 86,000 reservoirs of various types and the 6.4 million dams have a total reservoir capacity of 400 billion cubic meters. Over 8,200 irrigated regions of more than 10,000 mu have been built, more than 2 million mechanized and electricially operated wells were sunk, electrical machinery for drainage and irrigation total more than 7,000 horsepower, and installed hydroelectric power amounted to 20.98 million kilowatts.

Although China has realized the above achievements, in the utilization of water resources, there still are some problems:

1. The Waste of Water Resources Is Still Very Serious

The quantity of water used by agriculture at present accounts for about 88 percent of the total volume of water used throughout the nation, and is the sector that uses the most water. Most of the water is used for irrigation. In 1980, the nation's irrigated area was 670 million mu, constituting about 45 percent of the area of cultivated land. The output of the irrigated regions accounted for about two-thirds the total output of the nation. But at present, the quota for use of water for irrigation in agriculture is generally too high, the efficiency of water use is poor, the management level is low. Flood irrigation and furrow irrigation /chuanguan 0025 3487/ are more common. The annual quota for water use in fields of dryland crops is as high as 1,000 cubic meters per mu. The effective utilization coefficient of the canal system is very low, generally only 30 percent and 40 percent, and running water and leakage are serious. Most canals do not have seepage prevention measures. This irrational irrigation not only wastes water resources, it also causes the loss of fertilizers in farmland, affects soil fertility, and worsens the salinization and alkalization of the soil in some regions. During the latter period of the 1950's, secondary salinization of the soil occurred over large areas in the North China Plain. Although this was related to many factors, the main reason was the result of irrational irrigation.

Therefore, we must suit measures to local conditions to determine the rational irrigation system for different crops and conserve the use of water. First, we must study the amount of water needed by the different crops in each region. For example, the 32 mu of paddyfields in the Sujiadun ward in Shenyang City before 1974 used 800 to 1,100 cubic meters of water per mu per year. The unit yield per mu was 670 to 865 jin. Beginning in 1975, shallow irrigation and alternating dry and wet irrigation were used. In the drought year of 1978, the quantity of water used per mu was only 465 to 500 cubic meters, but a unit yield of more than 870 jin was realized per mu. This showed that by strengthening the management of farmland irrigation and by implementing a rational irrigation system, the potential for conservation is very great. In the future, as irrigation techniques develop, for example, as sprinkle irrigation, drip irrigation and seepage irrigation techniques are popularized over large areas, we can conserve over one-half the volume of water used.

Industrial use of water: At present, the degree of repeated utilization is low in the nation's cities, except for Dalian, Shanghai, Qingdao, and Tianjin. The potential is still great. According to estimates made in 1980 by the Natural Resources Comprehensive Survey Committee of the Chinese Academy of Sciences, the percentage of repeated use in Jinan was about 30 percent, and in Xuzhou and Shijiazhuang, it was less than 20 percent. In recent years, Beijing City has done a lot of work in conserving water. The rate of repeated utilization of water in the city was over 40 percent. The Beijing Waterworks Company inspected 132 air conditioned factories. If the amount of clean water released each day could be recycled for use, the amount of tap water conserved is sufficient to serve 560,000 residents.

The level of water consumption for urban living in China is not high but waste is great. This is mainly because water rates are not changed according to metered consumption. For example, the quantity of water used per person per day in Shijiazhuang City is one-fold over the general level for the nation. The reason is that water fees of about 60 percent of the residents are guaranteed. The average quantity of water used is equivalent to five times the quantity of water used by families with water meters installed. The residential households with water meters installed, according to statistics compiled by Beijing City, can conserve an average of one-third the amount of water used per month.

To sum up, at present, the waste in the use of water by the various national economic sectors is large. The reason is that there are problems in ideology as well as organizational management.

For a long time, some people have believed that water is "inexhaustible". Wasting a little does not matter; this idea is very harmful. We should realize that water is like other natural resources such as coal and petroleum, and they are all limited. Second, we must establish rules and regulations for the use of water according to the nation's concrete conditions and improve the management system. In farmland irrigation, we must gradually change the present method of charging fees based on the mu to a method of charging fees based on the quantity of water used. In cities, besides gradually implementing fees according to measurements, users that exceed the quota must be subjected to economic and legal penalty.

2. Water Pollution Is Becoming Worse

According to incomplete statistics, China releases more than 70 million cubic meters of sewage each day. Industrial sewage accounts for about 81 percent and domestic sewage accounts for 19 percent. Regionally, the amount of sewage released in the Chang Jiang river valley is the largest, constituting 45 percent of the national total. Because the water quality has been polluted, fish in some rivers and lakes have disappeared, and human health has been endangered. At some localities, the usable water resources has been reduced due to pollution. For example, in Shanghai which has an abundant water source, estimates by the Shanghai City General Hydrological Station showed that the incoming water, including runoff, produced by rain in that region and the water from the Tai Hu river valley upstream total 12.3 billion cubic meters,

but not all of this water can be used. The water quality in the Huangpu Jiang became worse after 1958; at present, 95 percent of the industrial sewage and domestic sewage are directly released into the Huangpu Jiang and its estuaries without being treated. This quantity approaches the volume of runoff from rain within the Shanghai area. Before 1958, the ratio between the volume of runoff and sewage in the Huangpu Jiang was 13:1 to 10:1. But now, this has dropped to 6.7:1. The number of days when the river water remains black and stinky ranges from over 10 days to several dozen days and even over 100 days each year. The seriously polluted segment of the mainstream of the Huangpu Jiang already accounts for 37 percent of the total length of the river and the sections are concentrated in downstream urban areas. In addition, during the dry season from November of each year to April the next year, salty tides come in and this greatly increases the chlorine content in the river water. At the same time, the tide water does not recede. It blocks the downward discharge of sewage into the river, the water quality worsens, and the possibility of utilization is reduced.

Moreover, in some natural lakes in the nation's arid regions, human activity has caused the water level of the lake to drop, the degree of mineralization of the water in the lake has risen and the value of utilization has been lowered. For example, Bosten Hu in Xinjiang was originally a fresh water lake with the largest inward and outward flow of water in the northern part of the nation, it receives the water of the Kaidu He. The river flowing from the lake is called the Kongque He. In recent years, some of the water of the Kaidu He was directly diverted into the Kongque He. This caused the average degree of mineralization of the water in the lake to rise from 400 milliliters per gram in 1958 to 1.5 grams per liter in 1975, and 1.8 grams per liter in 1980, and the lake has become slightly saline.

China has enacted an "Environmental Protection Law". The issue now should be conscientious implementation. We must change the past practice of setting a budget for payment of damage for discharging pollutants and of not having funds for treating sewage.

3. Economic Construction Did Not Fully Consider the Conditions of Water Resources. In the Past, Each Locality and Each Sector Did Not Fully Consider the Conditions of Water Resources When Planning Production.

In agriculture, because the nation's water and soil resources are not equal, this has brought about definite difficulties in developing irrigated farming. Generally, the annual runoff of the Chang Jiang and the Zhu Jiang river valleys in the south and the southeast coastal region and the river valleys in the southwest constitutes 52 percent of the national total, but the area of cultivated land constitutes only 36 percent of the national total. Therefore, generally speaking, there is an abundance of water. The annual runoff of river valleys in the arid north, including the river valleys of the Huai He, Huang He, Hai He, Luan He and the rivers in the northeast and the inland river valleys in the northwest constitutes 18 percent of the national total, but the area of cultivated land constitutes 64 percent. In these regions, the uneven distribution of water and soil resources has brought about many difficulties in water conservancy work. In the Beijing-Tianjin area, which has a shortage of water,

paddy rice that needs a large volume of water has developed quickly in recent years as a part of agricultural crops. After the major drought of 1972, the average sowing area of paddy rice from 1973 to 1977 in Tianjin was only 150,000 mu. In 1978, it rose to 570,000 mu, and in 1979, it reached 940,000 mu. In 1980, another major drought occurred, but it still rose to 960,000 mu. The sowing area of paddy rice in Beijing also increased from an average of 160,000 mu in the 1950's to 720,000 mu in the 1970's. Each mu of paddy rice in the Beijing-Tianjin area requires about 800 cubic meters of water but the amount of water used per mu of dryland is generally 300 to 400 cubic meters. The two differ by more than one-fold. Because of the increase in the planting area of paddy rice, the area of irrigated dryland will surely reduce.

The use of water in cities is even more serious. Because of the rapid increase in population, and with the industries that consume large amounts of water, some cities such as Tianjin, Qingdao, Dalian, Jinan, and Beijing generally have a shortage of water. Cangzhou, Shijiazhuang, Beijing and Jinan use a large volume of groundwater extracted as surplus to make up for the shortage. As the amount of groundwater extracted increased, sinking funnels of the groundwater table of varying sizes formed. The depth of the water table at the center of the funnel under Cangzhou in June, 1973, was 33 meters. By October, 1979, it had dropped to 68 meters, an average annual drop of about 6 meters. The southern suburb is more obvious. The water table of many wells drops an average of 1 to 1.5 meters a year. In Jinan City which is famous for its springs, the quantity of water in the springs has been greatly reduced or has even dried up because of the continued drop in the groundwater table.

In the future, we must consider the conditions of local water resources before construction is carried out. For example, to solve the shortage of water in Tianjin City, the state has begun building a project to divert water from the Luan He to help Tianjin. It is expected that each year, about 900 million cubic meters of water (with a loss of about 100 million cubic meters) can be supplied to Tianjin City each day. But if Tianjin City continues to enlarge the area of planting paddy rice in agriculture, and builds industrial and mining enterprises that consume large amounts of water, then, Tianjin City's water shortage cannot be alleviated.

4. We Did Not Use Water According to One Master Plan

China is a socialist nation. The utilization of water resources between the upper and lower reaches of a river, and between two neighboring regions should be uniformly planned and arranged in an overall manner. For example, since the 1970's, Tianjin City has had a shortage of water. The main reason is that since 1958, many reservoirs have been built in the mountain regions in the Hai He river valley, sharply reducing the quantity of water in the lower reaches. The use of water in Tianjin during the 1960's mainly relied on the water supply by the Miyun, Gangnan, Huangbizhuang, Wangkuai, Xidayang and Yuecheng Reservoirs. In the 1970's, many reservoirs stopped supplying water to Tianjin. Nineteen eighty was a major year of drought, this caused a severe shortage of water in Tianjin. Before completion of the project to divert water from the Luan He into Tianjin, the use of water in Tianjin City still has to be solved by diverting the water from the Huang He.

How to rationally utilize the runoff resources of the Huang He has been proposed and included in the daily agenda. Although the Huang He is the nation's second largest river, the average natural runoff over many years is only 56 billion cubic meters. At present, about 27 billion cubic meters of water are diverted, and waterflow in the lower reaches is frequently interrupted. From 1972 to 1981, there were 8 years when the waterflow stopped. The cumulative number of days without waterflow at the Lijin Station in Shandong Province has reached 118 days. The 666 kilometers of the river section below Gaocun in Shandong are without waterflow 12 to 32 days out of each year. Under present conditions, navigation, fishery and the supply of water to oil fields in the lower reaches have been greatly affected. Shanxi Province along the middle reaches is also planning and preparing to divert water from the Huang He at Yanbei. In this way, the question of how to rationally utilize the runoff resources of the Huang He urgently needs to be solved.

In summary, the way to solve the conflict between supply and demand of water resources is to open up new sources and reduce loss, develop new groundwater sources, desalinize sea water, utilize salt water, and produce artificial rain. But reducing loss is more important. Conserving the use of water is not an expedient way but a long-term strategic task. It is a key measure especially at present when there is a general shortage of water for use.

9296
CSO: 5000/4135

WAYS TO PREVENT POLLUTION OF THE CHANG JIANG OUTLINED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 12, 1982 pp 29-30

[Article: "Several Tasks That Should Be Emphasized To Protect the Sources of the Chang Jiang"]

[Text] To push forward the work of protecting the sources of the Chang Jiang, the Ministry of Urban and Rural Construction and Environmental Protection and the Ministry of Water Conservancy and Power jointly held a discussion meeting on protecting the sources of the Chang Jiang in Yichang, Hubei from 11 to 15 October. 100 people from the environmental protection bureaus, water conservancy (hydroelectric power) departments (bureaus) and related units of the seven provinces and city of Sichuan, Hubei, Hunan, Jiangxi, Anhui, Jiangsu, and Shanghai participated.

At the meeting, they studied and understood the spirit of the conference to exchange experience in preventing and controlling pollution by the industrial sector, studied how to control the pollution of the water system of the Chang Jiang on the foundation of summarizing the experience and the ways to protect the sources of water, and discussed "Several Regulations on Protecting the Water Sources of the Chang Jiang." Delegates believed that it was necessary to establish such regulations and would concentrate on this work after the conference, further revise the regulations and submit them to higher authorities for review and approval. The conference discussed and passed the "Regulations on the Work of the Water Quality Monitoring Network of the Chang Jiang Water System."

Chang Jiang is the largest river in China. It is 6,300 kilometers long, its annual runoff is about 1,000 billion cubic meters, the population in the river valley is about 360 million, spanning 18 provinces (cities, autonomous regions), the total output value of industry and agriculture accounts for 40 percent of the national total. Protecting the sources of the Chang Jiang well has a major strategic significance in promoting the construction of socialist material and spiritual civilization, protecting people's health and realizing the four modernizations. The Party Central Committee and the State Council are very concerned about the work to protect the sources of the Chang Jiang, they have instructed us more than once to do the work well. For several years, related environmental protection and water conservancy

departments along the river and the Chang Jiang Water Sources Protection Bureau exerted joint efforts and have done a lot of work to protect the water sources of the Chang Jiang, and have played an active role in controlling pollution.

At present, the major problem is that the industrial and mining enterprises along the river are releasing a massive amount of industrial sewage into the Chang Jiang, causing different degrees of pollution in the water regions along the banks of large and medium cities. Especially serious are the river segments along Dukou, Chongqing, Wuhan, Nanjing, and Shanghai. For a long time, the treatment of old polluting sources along the water system of the Chang Jiang has been slow, and new polluting sources continue to increase. If this situation is allowed to continue, it will surely bring about serious consequences in our economic development and people's lives, and harm future generations.

To quickly turn the situation of pollution of the sources of the Chang Jiang around and to push forward the work to prevent and control pollution by industrial enterprises, we must conscientiously implement the "Environmental Protection Law" (trial) and the "Decision on Strengthening Environmental Protection Work During the Period of National Economic Readjustment" promulgated by the State Council, insist on the principle that whoever pollutes must treat the pollution, and control and improve the pollution of the source of water in the Chang Jiang by readjusting the layout of industries, strengthening the management of enterprises, combining efforts with technical improvements, comprehensively utilizing resources and energy, and carrying out necessary purification and treatment of the "three wastes."

Delegates to the conference believe that with the arrival of the construction of socialist modernization in China, the Chang Jiang river valley will face a large-scale development of water resources and economic construction. These will surely directly or indirectly affect the water quality of the Chang Jiang.

Therefore, controlling pollution and protecting the water sources of the Chang Jiang are a very urgent and difficult task. To complete this task, we should emphasize the following points:

I. Strengthen Protection and Management of the Water Sources of the Chang Jiang

The people's governments at all levels within the river valley must include in their Sixth 5-Year Plan the prevention and control of pollution of the water sources and control the water quality of the Chang Jiang so that it will not become worse. The environmental protection departments and related departments of each locality must appropriately solve the mutual relationship between the mainstream and the tributaries, the upper and the lower reaches, the parts and the entirety while drawing up plans to protect the water sources of their own areas so that the water quality of the local water sources and the water quality of the mouths of the tributaries entering the

Chang Jiang, and the boundaries of water sources that span provinces, cities and regions are good. The Chang Jiang Water Sources Protection Bureau should cooperate with related environmental protection departments to draw up plans to protect water sources for key regions and key river segments, and should cooperate in supervising their implementation. Environmental protection departments are the departments in charge of supervising and managing prevention and control of water pollution in the mainstreams, and tributaries of the Chang Jiang within their jurisdiction. They should cooperate with concerned departments, and motivate all industries to do the work of protecting the water sources of the Chang Jiang well.

II. Conscientiously Concentrate on the Prevention and Control of Pollution by Old Polluting Sources

Concentrating on the prevention and control of pollution by old enterprises is an important measure to protect and to control pollution of the water sources of the Chang Jiang. At present, we must require that the pollutants directly released into the mainstreams of the Chang Jiang by large and medium cities do not continue to increase. The river segments along Dukou, Chongqing, Wuhan, Nanjing, and Shanghai that have been seriously polluted should be more strictly controlled.

The key to protecting the water sources of the Chang Jiang is to strictly control the 300 major polluting sources that seriously pollute the water. Each industrial administrative department should conscientiously implement the directive by Premier Zhao concerning the experience of self-reliance and comprehensively utilization of resources, energy and treatment of the "three wastes," by the Anshan Iron and Steel Company and the spirit of the conference to exchange experience in preventing and controlling pollution by the nation's industrial sector, establish practical plans and concrete measures to prevent and control pollution, propose stricter requirements to solve the problems in stages and in groups within a time limit. The Chang Jiang Water Sources Protection Bureau should coordinate with concerned provincial and municipal environmental protection bureaus to interfere in attempts to place the blame on others for pollution.

III. Strictly Prevent the Creation of New Polluting Sources

To strictly prevent the creation of new polluting sources in the mainstream of the Chang Jiang, concerned supervisory departments and the Chang Jiang Water Sources Protection Bureau should cooperate with environmental protection departments to report the situation and to supervise inspection. All basic projects for new construction, expansion and rebuilding must strictly carry out the regulation on the "three simultaneous efforts."

Large and medium projects that plan to directly release sewage into the mainstream of the Chang Jiang should present an environmental impact statement for review to the local environmental protection department in coordination with the Chang Jiang Water Sources Protection Bureau, and the implementation of such projects should be supervised by them.

IV. Stop the Destruction of the Water Environment, Prevent the Imbalance of the Ecology

While planning and designing large and medium projects, and developing, utilizing and regulating water resources, we should make overall plans and take all factors into consideration, maintain a rational amount of flow and water level in the mainstream of the Chang Jiang, the lakes and reservoirs, and prevent the destruction of the water environment. All those who blindly encircle land for reclamation, irrationally utilize side beaches, and sand bars, or pile and place toxic and hazardous substances at will, dump solid wastes and cause the river channels to silt and block up, pollute the body of water and cause the ecology to become imbalanced must be subjected to supervision and inspection by the Chang Jiang Water Sources Protection Bureau according to related regulations and in cooperation with the water conservancy departments and the environmental protection departments.

V. Strengthen Efforts to Monitor the Water Quality of the Chang Jiang

To accurately determine the water quality and changing trends in the water system of the Chang Jiang and to ascertain the quality of the water environment in the Chang Jiang, the 101 water quality monitoring stations (points) established by water conservancy departments, environmental protection departments and other related departments within the river valley should be organized into a water quality monitoring network. The operations center of the Chang Jiang water quality monitoring network is the central Chang Jiang water quality monitoring station. It is a component of the national environmental monitoring network and it is under the leadership of the Ministry of Urban and Rural Construction and Environmental Protection and the Ministry of Water Conservancy and Power. In its operation it is guided by the General Environmental Monitoring Station of China and the Bureau of Hydrology of the Ministry of Water Conservancy and Power.

9296
CSO: 5000/4122

DISTRIBUTION OF FLOURINE DISEASES, MEANS OF PREVENTION DISCUSSED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 7, 1982 pp 19-20

[Article by Sun Changren [1327 2490 0117]: "Hydrogeology and the Prevention of Fluoride and Water Improvement"]

[Text] Distribution of Fluorine in Nature

Fluorine is a chemical element that is widely distributed in nature, and it is a most active nonmetal. There are more than 86 types of known fluoride ores in the earth's crust, mainly fluor-spar, cryolite, fluoro-apatite, mica, and tourmaline. Some fluoride ores have a high content of fluorine, for example, the content in fluor-spar (CaF_2) is about 48 percent. Fluorine is also one of the trace elements needed in human activity and animal organs, but every type of trace element that enters the organs has a quantitative limit. Exceeding this limit or falling short of this limit would be disease causing factors. The health standards for the content of fluorine in China's drinking water is 0.5 to 1.0 milligrams per liter (mg/L). All regions poor in fluorine show a visible rise in the percentage of cavities due to tooth decay. In high fluorine disease regions, people afflicted suffer from an epidemic of tooth fluorosis; in serious cases, the victims suffer pain in the waist, back and legs and other major symptoms which are typical of sufferers of fluorine osteopathy. This fully shows that the physiological effect of fluorine in the human body is obvious. Ingestion of overdoses of fluorine over a long period will cause fluorine poisoning.

The Distribution Pattern of Fluorine Diseases

Fluorine diseases are distributed widely in China. In the macrocosmic view, the disease regions extend from the western part of the Song-Liao Plain in the northeast, Inner Mongolia, Datong in Shanxi, the loess plateau in Shaanxi Province, the Jilantai Salt Lake in the Ningxia Autonomous Region, Gansu, Qinghai westward to Lop Nor in the Xinjiang Autonomous Region, Hami, and Guitun, generally from east to west in a discontinuous belt. The regional characteristics of the above distribution show that the distribution of fluorine diseases is closely related to the climate, topographic position, composition of geostrata, geological tectonics, hydrogeological conditions, environment and geochemistry.

Aridity and Evaporation Have Created Conditions for the Development of Fluorine Diseases

The geographic locations of the disease regions are all arid and semi-arid regions. The annual rainfall does not surpass 200 to 400 millimeters and evaporation can reach over 1,000 to 2,000 millimeters. The amount of evaporation far surpasses the amount of rainfall, and over 50 percent of the rainfall is concentrated in summer. Concentrated rainfall is favorable to the formation of surface runoff, and leaching and migration of fluorine containing minerals. Fluorine in mineral ores moves from the mountain regions or higher elevations to the lowlands following changes in geomorphological conditions and filters underground joining well water. The fluorine in the bodies of water is concentrated when the underground water dries up and evaporates over a long period. People use flouridated ground water for drinking water or irrigation, allowing the fluorine ions in the water to be absorbed by the human body. And after a long time, form today's high fluorine disease regions.

Observing the Distribution of Fluorine Diseases From the Geochemical Differences of Salts

Another characteristic of the disease regions is that leaching, migration, and accumulation of fluorine and geochemical differences of its salts have a distinct pattern.

There are large amounts of igneous rock and extrusive rock in China's northern provinces, cities and regions. In particular, recent volcanic activity has provided a lot of fluorine in the disease regions.

In China's western and northwestern regions, the ground surface has a concentration of large amounts of chlorides--sulfates. In northern China, the western plain in the Northeast and the grasslands in Nei Monggol, and the semi-arid regions in the middle reaches of the Huang He, results of differentiation of ground surface salts show that they are mainly carbonates and double carbonates, forming a concentration zone mainly of soda salinized soil. It is also a region of alkaline-rich environment. This region not only has the geological background of forming abundant fluorine because of the formation of igneous rock, effusive rock and recent volcanic activity, the activity of fluorine in the soil and in ground water is greatly increased because of the alkaline environment. Therefore, the area of the disease regions is large and the diseases are serious. Conversely, although regions of fluorine diseases are also widely distributed in the northwest and along the coast, due to the effect of geochemical differentiation, they are mainly fluoride and sulfate concentration zones, and regions along the coast are mostly of fluoride sediments forming non-alkaline and calcium-rich geographic environments, thus reducing the activity of fluorine.

Only By Clearly Understanding the Regional Hydrogeological Conditions Can We Know the Distribution Pattern of Water With a High Fluorine Content

Fluorine enters the human body via water (mainly ground water) and foods and damages the normal physiological functions of the human body. We know that

replenishment, runoff, and drainage of fluorine containing ground water are controlled by local geological and hydrogeological conditions, and geomorphology and lithological conditions. In different hydrogeological conditions, the distribution of water with a high fluorine content is also different. For example, the water with a high fluorine content in the western plains of the northeast differs from the water with a high fluorine content in the regions in North China and the northwest in the scope of distribution, conditions of replenishment, and depth. The western plain in Jilin is a low plain formed by alluvial and lacustrine sedimentation. In particular, the lumpy marshland between the Liao He and Nen Jiang is a noncontributing area. The deposition, distribution and formation of hydrological and geochemical effects all show an asymmetric belt-shaped distribution from the southern and northern sides towards the center, that is, ground water is deposited from the deeper parts towards the shallow parts, runoff and alternation weaken, and the chemical type of the ground water is mainly of the HCO_3_Cl_Na type. In such a specific geological and hydrogeological environment, the nation's famous high fluorine disease region is formed. For example, in the Changling and Tongyu areas west of Changchun, the fluorine content in shallow ground water is higher than 5 mg/L. According to surveys by concerned departments, in regions where the fluorine content in drinking water is 1.5 to 5.0 mg/L, the percentage of fluorine disease among a population of 878 people is 41.6 percent. In regions with a content of 10.0 mg/L, the percentage of fluorine disease among a population of 198 people is 50 percent.

The distribution of water with a high fluorine content in the North China plains is generally in regions of lacustrine and marine deposits. The lithological character of the water bearing strata consists mostly of pulverized and fine sand. Runoff conditions for ground water are poor. Fluorine containing ground water easily evaporates here to form a high fluorine ground water region. Fluorine diseases are mostly distributed in such regions with poor hydrogeological conditions.

Characteristics of Formation of Fluorine Diseases in the Loess Plateau

In the northwest loess plateau, the disease regions exist because of the presence of mica, hornblende, tourmaline, fluoro-apatite, and other fluorine containing minerals. Fluorine ions are carried by flood waters with large amounts of mud and sand after rain into the lowlands, basins and river beaches, and then filter into ground water to form high fluorine water. The ground water in this region has little lateral replenishment and relies mainly on the limited rainfall. Drainage of ground water mainly relies on vertical evaporation. Therefore, fluorine in the ground water must concentrate and elevate. This is the formation of the high fluorine disease regions in the specific environment of the loess region.

Characteristics of the Formation of High Fluorine Disease Regions in the Southern Part of China

The above introduced the distribution characteristics of fluorine in ground water in the northern regions. Actually, fluorine diseases are also distributed in the south, but in view of the national distribution, there is a

lot of difference between north and south. The South is damp and has a lot of rain. They serve a strong leaching function for fluorine in the weathered crust of the ground surface and in the soil. Therefore, concentration of fluorine in water does not exist. Then, why are there also regions of fluorine poisoning in the south? According to surveys, varying degrees of fluorine disease regions are found in Zhejiang, Shandong, Hubei, Guangdong, Yunan, Guizhou and Xizang. Because fluorine not only exists in ground water, it also exists in rocks, soil, plants and air. Residents in Yunnan and Guizhou have the habit of eating baked foods using coke with a high content of fluorine. Thus, fluorine diseases have become widespread. Large amounts of fluorine are found in the hot springs of Xizang and Guangdong, and are regions where high fluorine diseases originate.

The above situation shows that the genesis, development, and distribution pattern of regional fluorine poisoning are closely related to geological and hydrogeological conditions, the climate, and geochemical characteristics. Therefore, the key to preventing fluorine diseases is how to reduce the factors that bring about the presence of fluorine ions, change the distribution of fluorine in the environment, and reduce the possibility of fluorides entering the organs through biological cycles.

To enable the broad number of people in the disease regions to drink water and to eat foods that meet health standards as soon as possible, the following suggestions are presented from the hydrogeological point of view:

(I) On the basis of fully utilizing existing hydrogeological data, we should carry out special regional hydrogeological surveys, further investigate the distribution characteristics of each water bearing layer (group), investigate the range of distribution of water with a high fluorine content and water with a low fluorine content, and use the conditions in the diseased regions, the chemical types of ground water, the conditions for replenishing runoff and drainage, the degree of mutual influence among topography, geomorphology, lithological character and meteorology, to draw topical maps to prevent fluorine contamination and improve water.

(II) Hydrogeological work in the loess plateau must be aimed at the regional characteristics. Engineering and geological factors to treat soil erosion must be studied for the purpose of restoring natural vegetation, reducing soil erosion, and protecting the relative stability among the geochemical elements in the geographic environment, as well as to protect the relative balance of the content of fluorine in the regional formations, reduce the chance of formation of high fluorine environments, and provide a scientific basis for guarding against regional fluorine poisoning.

(III) In high fluorine disease regions without superior quality water bearing layers, we should think of ways to find surface water as the source of drinking water.

(IV) In some areas, we can consider the use of chemicals to reduce fluorine.

9296
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PROVINCIAL REGULATIONS ON MANAGING WATER RESOURCES PROMULGATED

Surface, Ground Water

Taiyuan SHANXI RIBAO in Chinese 3 Jan 83 p 2

/"Shanxi Province's Regulations on Management of Water Resources"/

/Text/ Chapter I, General Principles

Article 1. These regulations are formulated according to the rules on the protection of natural resources stipulated by the constitution to strengthen unified management of water resources, to rationally develop, utilize and protect water resources so as to meet the needs of building the province's energy base, developing industrial and agricultural production and the domestic use of water.

Article 2. This regulation is applicable to all surface water and groundwater resources within the territory of Shanxi.

Article 3. Water resources belong to the state. All water consuming units and individuals within the jurisdiction of the province, including agencies, organizations, troops, neighborhood units and enterprises and business units, rural communes and brigades, must implement this regulation.

Chapter II. Water Resources Management Agency

Article 4. Water resources management committees shall be established in the province, the prefectures and provincial municipalities. The water resources management committee at each level shall consist of representatives from related departments at the same level. The business agency shall be located in the water conservancy department at the same level and will be in charge of daily matters.

The water resources management committee at each level shall be guided by the supervisory department of water resources management of the level above.

Article 5. The duties of the water resources management committee shall be:

A. to implement the various principles and policies on water resources issued by the central authorities, and to carry out laws, rules, policies and administrative laws on water resources promulgated by the state;

B. the provincial water resources management committee shall be responsible for drafting local laws concerning the water resources of the province;

C. to organize surveys and evaluation of water resources, to study the supply and demand for local water resources and the developmental trend at each stage, according to the requirements of national economic development, and to propose countermeasures and suggestions;

D. to organize, compile, and review plans for comprehensive development and utilization of local and regional water resources;

E. to uniformly manage local water resources, uniformly allocate, coordinate and solve conflicts in the use of water;

F. to protect water resources from pollution and destruction;

G. to establish measures to conserve water, to award conservation efforts and penalize waste;

H. to organize and coordinate major scientific research work on water resources;

I. to complete other related tasks handed down by the provincial people's government.

Article 6. The water resources supervisory departments of the county and the municipal wards are: the county and municipal ward water conservancy bureaus, with duties stipulated in reference to Article 5, to carry out managerial work related to water resources of their own localities.

Chapter III. Water Resources Management

Article 7. Each water user should positively adopt measures to implement the planned use of water, conserve the use of water, improve the rate of repeated utilization of water, and gradually establish a system to assess the use of water.

Article 8. The water resources supervisory departments at each level shall establish water resources management and protection zones of different levels, according to the degree of importance and natural conditions of the water resources within the area of their own jurisdiction, implement management by level and establish corresponding management methods.

Article 9. Each water user and its supervisory department shall follow the regulations stipulated herein and be responsible for the management and protection of the water resources which they have obtained the right of use.

Article 10. The water resources supervisory department at each level shall uniformly plan the use of surface water and groundwater resources, appropriately handle the needs and possibilities for the present and the future, the local and the overall, the upper reaches and the lower reaches, and the relationship between the departments and the regions, and shall fully utilize water resources, and protect and improve the ecological environment.

Plans for the use of water by special sectors must be drawn up according to needs on the basis of plans for the comprehensive development and utilization of regional water resources for the sectors that use large amounts of water, including the coal industry, electric power industry, metallurgical industry, chemical industry, and light industry. Plans for the comprehensive development and utilization of regional and river valley water resources shall be submitted to the people's government one level above for review and shall be filed with the water resources supervisory department of the level above.

Article 11. The development and utilization of groundwater must be in accordance with the conditions of groundwater and surface water resources. They shall be uniformly planned, the depth of the wells, the distance between wells, the amount to be pumped, the period of pumping and the requirements for refilling shall be rationally determined.

Deep wells are prohibited from being drilled in regions where groundwater has been overly extracted. The drilling of deep wells shall be strictly controlled in other regions.

Article 12. All units that need to develop and utilize water resources must apply for permission from the local water resources supervisory department according to the amount of water to be extracted and the location of the water source.

Based on related regulations and procedures for capital construction stipulated by the state, all projects that need to survey and investigate water resources must first apply for permission from the local water resources supervisory department and must obtain a surveying permit.

After a survey report, a design for the project to develop the source of water, and a plan for the use of water have been drawn up, they shall be reviewed by the supervisory unit of their department, and shall be reported to the local water resources supervisory department for approval, and permits for the development and use shall be obtained.

Current projects to develop water sources and plans for the use of such water sources must carry out approval procedures within a definite time.

Article 13. In building water conservancy projects, whoever benefits shall invest. Investments in joint projects shall be shared on the basis of the proportion of use of water.

If the water conservancy project under construction affects the legal benefits of the original water using unit, the loss thus brought about shall be compensated for by the new water using unit.

Article 14. In any one of the following cases, the water resources management committee shall have the right to adjust the use of water by the water user.

A. when the situation of the water resources change;

B. when the amount of water needed by the water user and other requirements change;

C. when the need for water by public enterprises and sectors with a high economic benefit increases;

D. when there are other special needs by the state.

When readjusting the use of water according to sections B and C of this article, the loss of the original water user shall be compensated for by the benefiting department. When readjusting the use of water according to section D of this article, the loss of the original water user shall be compensated for accordingly by the state.

Chapter IV. Protection of Water Resources

Article 15. Each agency, organization, troop, neighborhood, enterprise and business unit, rural commune and brigade and individual has the duty to protect water resources. When developing and utilizing water resources, prospecting, coal mining, mining ores, building underground projects and carrying out other activities, water resources must not be polluted and destroyed.

Waters already polluted and damaged shall be quickly remedied by implementing effective measures. The cost needed shall be borne by the perpetrator.

Article 16. All approved construction facilities for developing and utilizing various types of water resources and protected zones determined by related regulations shall not be occupied and destroyed by any unit or individual.

Article 17. Water resources management committees shall organize such related departments in water conservancy, geology, environmental protection, urban construction, and sanitation to determine the establishment of water quality monitoring stations, networks, and long-term monitoring networks to observe groundwater movements according to the principles of rational division of work and particular emphasis to develop water quality monitoring work.

Article 18. Each water quality monitoring station must not only complete the routine monitoring tasks stipulated, it shall also have the right to track down the polluting source, investigate and monitor the damage caused by pollution and discharge conditions. The units under investigation must provide accurate information to the water quality monitoring station for it to carry out its duties, shall cooperate closely with the station and shall not use any excuse to interfere or refuse to comply with the station.

Chapter V. Fees, Awards and Punishment

Article 19. The water resources supervisory department at each level shall levy water resources fees according to the amount of water extracted by units having their own water sources. The standard for the levy shall be 3 to 6 fen per ton.

The water resources fee shall be levied by designated water resources supervisory department. The water resources fees levied shall be submitted to the treasury, included in budget management as a special fund for water resources management and the fund shall not be used for other purposes.

Drinking water for people and domestic animals in rural areas, and water for farmland irrigation temporarily shall not be subjected to the levy of water resources fee.

Article 20. To maintain continued reproduction of water supply projects, each reservoir, irrigated region, mechanized and electrically powered irrigation station shall determine the price for water and shall collect fees for water use from the users according to the cost of supplying water and related policies. The standard for the levy shall be based on different conditions. Water for industrial and domestic use shall be charged 6 fen to 1 jiao per ton. Water for farmland irrigation shall be charged 8 li to 1 fen 5 li per ton. The charge for water used for irrigation by machinery and electric power shall be appropriately increased according to the amount of energy consumed.

Article 21. Each water user must install water meters, implement plans for use of water, submit water fees or submit water resources fees according to regulation. The water supply department shall have the right to stop the supply of water to those who do not submit the fees in time. The water resources supervisory department shall have the right to seal private water sources.

A water user that exceeds the quota shall be charged a fee calculated cumulatively on the amount over the quota. The additional water resources fees and water fees levied on the extra amount of water beyond the quota stipulated in the plans for water use shall not be included as a cost. The fees shall be paid from the capital fund of the enterprise or by a portion of the profits.

Article 22. Units and individuals with outstanding records in protecting water resources and in conserving the use of water shall be praised and awarded by the people's government at each level. Those who waste, pollute and destroy water resources shall be given the necessary administrative punishment according to the seriousness of the situation and shall be subjected to economic sanctions until the legal responsibility is investigated.

Article 23. Units that violate this regulation shall be responsible for the fine according to regulation, and based on the situation, the individual responsibility of the leader of the unit and the manager shall be investigated, and their current monthly monetary awards as well as 10 to 20 percent of their wages shall be withheld.

Chapter VI. Appendix

Article 24. When this regulation conflicts with state laws, orders and rules promulgated by the state water resources supervisory departments, state laws, orders and rules shall take precedence.

Article 25. Concrete methods for managing river runoff, groundwater, and spring water resources shall be established by the provincial water resources management committee according to the regulations stipulated herein and shall be submitted to the provincial people's government for approval, promulgation and implementation.

'Regulation's' Impact on Economic Growth

Taiyuan SHANXI RIBAO in Chinese 3 Jan 83 p 2

/Commentary/

/Text/ The "Shanxi Provincial Regulations On Management of Water Resources" have been promulgated. The regulations have important meaning in strengthening unified management, protecting and rationally developing and utilizing water resources, in promoting the development of industrial and agricultural production, and in improving the domestic use of water. The regulations are also important for the realization of the glorious goal of quadrupling output.

As agricultural and industrial production develop and as the material and cultural standards are raised, the need for water will continue to increase. But Shanxi's topography is complex, the climate is arid, and water resources are scarce. The total quantity of water resources averaged over many years in the province is only 14.2 billion cubic meters, ranking second from last in the nation. By population average, this is only equivalent to 17 percent of the national per capita volume of water. With the great variation in the quantity of water resources between years and the extremely uneven distribution, the quantity of water that can actually be controlled and utilized is even less. In a province such as ours which has a serious shortage of water, the protection and management of water resources should attract sufficient attention.

Since the founding of the nation, many water conservancy projects have been built in Shanxi. In the area of water resources, a lot of basic work has been done and has played a role in flood prevention, irrigation, and water supply. But because of the lack of unified management and overall planning for water resources, the competition for water between industry and agriculture and between sectors has continually occurred. Some regions have overly extracted groundwater, causing the groundwater table to drop by a large scale, the ground surface has settled, and many famous springs are gradually weakening. Some factories and mines have discharged sewage at will, causing water pollution to worsen. The management of water use and water supply are not planned, there are no quotas, and the rate of repeated utilization is low because everyone drinks "water from the same big pot". This causes serious waste. In rural areas, some individual commune members invested in sinking wells. This should have been a good thing, but because there were no unified plans, wells have been sunk without order. These will all cause disastrous destruction of water resources.

Shanxi is an important energy base of the nation. As the coal industry and electric power industry develop and as coal is comprehensively utilized, the

need for water will become greater and greater. We must develop the superiority of coal on the one hand, on the other hand, we are also faced with the inferior situation of a lack of water sources. This is a sharp conflict that has existed for many years without solution and has now become very urgent. Solving this problem is not only greatly related to the development of the economy of Shanxi, it also affects the whole nation's supply of energy and the entire economic construction. The leading comrades of the Central Committee have repeatedly pointed out: If Shanxi does not solve its water problem, nothing can be solved, and even if the other aspects progress, they will have to be withdrawn. Therefore, we must use legal means to strengthen water resources management, readjust the many relationships related to water resources, improve the comprehensive economic benefit in developing and utilizing water resources. Every locality throughout the province and every industry must conscientiously implement the "Regulations on the Management of Water Resources", concretely obey the law and strictly implement the law. At the same time, propaganda work must be done well, the masses must be educated to protect water sources, conserve the use of water, and create new prospects in industrial and agricultural production that conserve water.

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AQUATIC LIFE RETURNS TO ONCE DEAD RIVER

Beijing BEIJING RIBAO in Chinese 14 Jan 83 p 2

[Article by Huang Huachang [7806 5478 2490]: "Treatment of 46 Polluting Sources on the River Bank Is Effective; Lianhua He Again Has Fish and Frogs"]

[Text] After 10 years of comprehensive treatment, the water of the Lianhua He, once seriously polluted, has improved in quality. Recently, when this reporter visited Sanyiqiao and Wujiacun outside of Guanganmen where the Lianhua He flows past, foul odors were no longer present. According to comrades of the city's environmental protection bureau, some small fry have been discovered in the upper and middle reaches of this river and the people in the Wujiacun area can now hear the frogs croak in summer.

The Lianhua He, formerly called the Qingquan He, originates at Baimiaocun in the Shijin mountain region in the north, flows through Shijinshan, Fengtai and Xuanwu Prefecture to Wanquansi outside of Guanganmen, where it joins the Liangshui He. It is 16 kilometers long. Since the 1950s, over 20 factories including the Capital Steel Works, Special Steel Plant, Beizhong, Ertong, and Beijing Steel Works have released massive amounts of industrial sewage into the river, causing the water to become seriously polluted. The water became turbid and a pungent smell was emitted, fish, shrimp and other aquatic animals in the river completely disappeared. Monitoring by the environmental protection department showed that the river contained phenol, cyanogen, chromium, acids and other toxic substances. The Lianhua He became a dangerous river. Comprehensive treatment of this river began in 1973. In recent years, each concerned unit implemented the four directives issued by the Central Secretariat for building the capital city, strengthened treatment work, and implemented effective measures to treat the 46 polluting sources and controlled pollution.

The Lianhua He is a sewage draining river. Besides the massive amount of industrial sewage that pollutes this river, there is also a lot of residential sewage which needs to be further treated.

9296
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ACID RAIN PREVENTION DISCUSSED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983 pp 8, 9

[Article by Cheng Zhenhua [4453 2182 5478] and Liu Jibin [0491 4764 2430]: "How to Prevent and Control Acid Rain in Our Country"]

[Text] Acid rain is mainly attributed to the presence of sulfuric dioxide in the atmosphere. Thus, the most fundamental way to prevent and control acid rain pollution is by minimizing sulfuric dioxide discharge.

Based on 1981 statistics, the amount of sulfuric acid discharged for the whole year in China amounted to 14 million tons, which was twice the average load of acid rain on land in the world. Coal is the chief source of energy in our country, and accounts for approximately 70 percent of the energy sources. Specifically, among the various kinds of fuels, coal accounts for the highest percentage of directly-burned fuel. China also happens to be a producer of high-sulfur coal; the sulfur contents are largely somewhere between 0.3 percent and 5 percent, and a small proportion of coal is known to contain over 5 percent sulfur. High-sulfur coal fields are widely distributed and quite a few of them are being mined. A very large proportion of high-sulfur coal is found in Shandong, Sichuan, Guizhou and Guangdong; next in proportion are Shaanxi, Shanxi, Hebei, Nei Mongol, and Liaoning (mostly in the southeastern part). In the southwest region, the highest average content of sulfur in coal is 3.23 percent; in the northwest region, the sulfuric contents in coal is 3.05 percent; in the central south region, sulfuric contents is 2.02 percent. In the southwest region, high-sulfur coal accounts for 61.62 percent. High-sulfur coal will become one of the country's main sources of energy. Thus, one effective way of preventing and controlling acid rain pollution is by finding out how to exploit and utilize the sulfuric resources in coal mines.

1. Fully develop coal washing and processing, and combine coal mining with the exploitation of sulfuric resources. At present, China's coal preparation capacity has reached 110 million tons per year; but only 80 million tons per year of coking coal and export coal require preparation, which leaves a coal preparation of only 30 million tons per year. The main cause behind the high rate of discharged sulfuric dioxide in the country lies in the practice of washing coking coal only, and rarely washing high-sulfur power-station

coal. Due to irrational target planning and pricing, the current coal preparation capacity has not been fully tapped either. If an additional coal preparation capacity of 100 million tons per year can be installed and fully exploited in high-sulfur coal producing regions prior to 1990, it will then be possible to wash most of the high-sulfur coal containing over 2 percent inorganic sulfur; as a result, 2 million tons of sulfide concentrates can be recovered annually, which amounts to 100 million yuan, thus gaining 80 million yuan worth of profit. This way, our country will not have to spend 40 million U.S. dollars each year on 300,000 tons of imported sulfur. On the contrary, it will be in a position to export large quantities of the mineral. The proposed project will require approximately 1.2 billion yuan of capital investment; but on weighing pros and cons, one will find tremendous economic advantages. Besides, by equipping mines with preparation and processing means, it will be possible to expand mining range, i.e., to mine both high ash coal seams and intergrown coal seams, thus extending the life of a coal pit and fully exploiting coal resources; moreover, it will help to improve the quality of coal products, increase actual yields, eliminate waste rocks, reduce pressure on transportation, increase production and recovery, cut down pollution, and thereby reaching the goal of optimizing combined economic results.

The reason we have not been able to put into effect such a good idea mainly lies in the irrational pricing policy and planning of targets. Our country's coal production plans are based only on tonnage indexes and not on calorific (heat) indexes. Moreover, in coal preparation, we have not been able to produce top quality coal at a good price. Consequently, unprepared coal is being shipped away, thus resulting in 50,000 to 60,000 tons of rocks being shipped each year by our already heavily-ladened transportation system, not to mention the serious pollution problems brought on to our environment. Hence, we suggest that concerned departments should put coal preparation and processing on their agenda; they should conduct special studies and come up with appropriate policies and regulations.

2. Carry out such measures as "produce and transport separately," fixed-point supplying, and rational distribution of coal, which involves both production management and planning management, as well as increasing mining and shipping costs. As sulfur contents vary from seam to seam, if possible, it is best to produce and ship high-sulfur and low-sulfur coal separately, instead of the old practice of mining and shipping them together. Moreover, fixed-point supplying should be practiced by shipping high-sulfur coal to plants with desulfurization capability, and low-sulfur coal to plants without desulfurization capability. At present, some thermal power plants do not get steady supplies of high-sulfur coal although they are equipped with desulfurization units. Conversely, some plants are supplied with high-sulfur coal although they are not equipped with desulfurization capacity at all, thus allowing them to pollute the environment. This kind of irrational distribution and supply system should be changed as soon as possible. In our country, some 40 million tons of coal are consumed by nitrogenous fertilizer and non-metallurgical coking plants each year; to meet production needs, they should be equipped with desulfurization units and supplied with high-sulfur coal. The problem lies in the fact that some plants have to be further equipped

with the ability to convert hydrogen sulfide into sulfur before it is possible to replace imported sulfur. Otherwise, the stripped hydrogen sulfide will escape into the atmosphere, causing waste of resources and environmental pollution.

3. Selectively adopt the "fumigation desulfurization" technique, and recover sulfuric dioxide. Although it is possible to separate inorganic sulfur from coal through coal preparation and processing, organic sulfur cannot be separated this way. Thus, when coal is used as a fuel, it is important to utilize the fumigation desulfurization technique to recover sulfuric dioxide and produce sulfuric acid. This requires a fairly substantial amount of capital construction funds (e.g., 20 to 25 percent of additional capital construction investment is required when building a power plant), but, in terms of actual costs, the application of the fumigation desulfurization technique for producing sulfuric acid costs less than using imported sulfur (550 yuan per ton) for acid production. Thus, it is economically feasible.

At present, some people propose extending the height of chimneys so as to discharge [smoke] into the upper air. This method can definitely help to cut down on capital construction investment and reduce air pollution in the vicinity areas of the chimneys; it will not greatly affect the immediate or adjacent areas either. But it often gives rise to another kind of serious problem, i.e., smoke can drift to other areas and cause pollution there. In foreign countries, there have been quite a few cases of smoke drift pollution, e.g., in West Germany's Ruhr industrial area, tall chimneys are quite common; the tallest chimney measures 243 meters. The discharged sulfuric dioxide fumes drift to places in northern Europe and can reach as far as 2,000 km, seriously endangering Norway. Eighty percent of the sulfate in the Norwegian atmosphere comes from West Germany and Sweden. The eastern part of Canada is invaded by 4,000,000 tons of corrosive sulfuric dioxide, nitrides and oxides each year, and the hydrogen ion exponent [pH value] in some of the lakes there have increased 5-40 times. The Canadians believe that the pollution is mainly caused by coal fuel thermal power stations in the United States. In view of harmful effects on the atmospheric environment by discharging sulfuric dioxide into the upper air, most nations propose to enforce strict control over the discharging of sulfuric dioxide fumes. But some countries, such as England and Germany, who only have a small territory, are not greatly affected by the discharging of sulfuric dioxide fumes into the upper air as most of the fumes drift abroad; thus, they are still in favor of using tall chimneys to dilute and discharge sulfuric dioxide fumes. In our country, except for thermal power stations which have relatively tall chimneys, most chimneys are under 30-60 meters and are much shorter than foreign chimneys. But there is a tendency to develop taller chimneys. China is a country with a vast territory. High altitude discharging does not reduce the overall volume of sulfuric dioxide discharged into the atmosphere; as sulfuric dioxide drifts, it is bound to cause regional damage in the country. Thus, high altitude discharging is definitely not a good way of controlling pollution.

4. Carry out the construction of urban coal gasification in a planned way. [Urban gas] is already pretty common in foreign countries. In our country, the modernization construction program should include planned development of coal gas in some large cities, which will help conserve energy, bring conveniences to the masses, and reduce atmospheric pollution in cities. At present, over 80 percent of household fuel coal in our country consists of loose coal, which is the main cause of urban air pollution. This situation must be changed as soon as possible; shaped coal should be developed. When processing high-sulfur coal into shaped coal, most of the sulfuric dioxide should be stripped to help reduce urban air pollution.

Quite a few successful experiences have been gained in the effort to improve the quality of the atmospheric environment over the past few years, and many pollution control methods have been developed. The key lies in whether to "set aside funds for pollution control now, or suffer infinite disasters later." We must put our shoulders to the plow, and resolve to turn out results.

In China, acid rain pollution has already become an environmental problem which has to be dealt with and solved. We should start from combined utilization of coal and sulfur resources, adopt multiple measures, greatly reduce the discharging of sulfuric dioxide, formulate strict regulations on atmospheric discharging, and cut off sources of pollution caused by acid rain. This is the only way to completely control and solve the acid rain pollution problem.

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ACID PRECIPITATION IS A SERIOUS AND GROWING PROBLEM

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 12, 1982, pp 24-27

[Article by Ji Bin [4764 2430] and Cheng Zhenhua [4453 2182 5478]: "Acid Rain in China"]

[Text] Acid rain has been called the "deadly demon in the sky", it is one of the major global environmental issues at present. Although our industry is still somewhat backward, because the atmosphere has been polluted, the problem of acid rain has become increasingly serious. According to recent national data, acid rain covers a large area, the acidity is high, and is no worse than the situation in Europe, North America and Japan. We must be seriously concerned.

I. Acid Rain in China Is Very Serious

Acid rain generally refers to acidic precipitation with a pH less than 5.6, it includes rain, snow, hail and fog. Generally speaking, natural rain is always slightly acidic, its pH is about 6 to 7. This is because some of the carbon dioxide dissolved by clean rain water forms carbonic acid. Data measured on Huangshan and Hengshan show that the pH rain water is 6.84 and 6. The weak acidity of precipitation can dissolve nutrients in soil for organisms to absorb, therefore, it benefits the human environment. But when the acidity of precipitation rises and the pH approaches or becomes smaller than the pH value (5.56) of saturated water solution of carbon dioxide, it will unfavorably affect the natural ecology.

China began late in monitoring and studying acid Rain. Some work was done in the western suburbs of Beijing beginning only in 1974. In 1979, Beijing, Shanghai, Nanjing, Chongqing, and Guiyang began to carry out this work. The 1980 report entitled "Basic Conditions of Environmental Quality in Some Regions and Cities in China" compiled by the former writing group of the Office of Environmental Protection Leading Group of the State Council pointed out that acid rain is an obvious potential problem at present. It should attract a high degree of concern. This was the first official mention of the problem of acid rain in evaluating the national environmental quality in China. In December, 1981, the national environmental protection science and

technology information network and the environmental sciences information network of the Chinese Academy of Sciences jointly held a "Discussion Meeting on Precipitation Pollution and the Acid Rain Problem" in Beijing. Many reports presented at this meeting showed that acid rain has occurred in some of our cities. Acid rain frequently occurs in some cities and the acidity is high. To understand clearly the extent of acid rain throughout the nation and in order to quickly provide a scientific basis for determining countermeasures to prevent and control it, the former Office of Environmental Protection Leading Group of the State Council issued a "Notice on Conducting a General Survey of Acid Rain throughout the Nation" in March of this year.

Although this national general survey was not carried out in some provinces, cities and autonomous regions, moreover, the data points were few, the points of distribution were irrational, the comparability of data was poor, but the more than 2,400 measurements reported as of the end of October by 121 monitoring stations above the prefectural level in 23 provinces, cities and autonomous regions were sufficient to make an estimate of the acid rain problem in the nation at present. Acid rain in China has far surpassed the degree of being a potential problem, it has become an increasingly serious regional environmental pollution problem. It is mainly manifested in the following (for details, see accompanying table):

(A) The Frequency of Acid Rainfall is High

According to data from 23 provinces, cities and autonomous regions, acid rain has occurred in all of the provinces, cities and autonomous regions, except for Jilin, Gansu and Ningxia, constituting 87 percent. Among the monitoring stations participating in the survey, 55 stations measured acid rain, constituting 45.5 percent. Among the 2,407 monitored measurements (i.e., total number of sampling points), 1,071 measures acid rain, constituting 44.5 percent. These figures show that acid rain in the nation is not a special phenomenon that occurs in individual cities but is a definite widespread and serious problem.

(B) The Distribution of Acid Rain Displays Clear Regional Characteristics

To more clearly explain this problem, we divided the frequency of acid rainfall in each province, city and autonomous region as a percentage of the total number of samplings in each of these provinces (cities, autonomous regions) into five levels. We also divided the number of monitoring stations above the prefectural level that have detected acid rain in each province, city and autonomous region as a proportion of the total number of monitoring stations above the prefectural level in each province, city and autonomous region participating in the survey into two major categories (See accompanying Table 1). The results showed that the frequency of acid rainfall belonging to level 3 was registered in 12 provinces, cities and autonomous regions, constituting 52 percent of the 23 provinces, cities and autonomous regions participating in the survey. In nine provinces, cities and autonomous regions, over 45 percent of the total number of monitoring stations in these respective provinces, cities and autonomous regions were in

areas where acid rain was detected, constituting 39 percent of the provinces, cities and autonomous regions participating in the survey.

The geographic distribution of acid rainfall shows that it is concentrated in the southwest, south central and eastern China, and is progressively becoming more serious from north to south. The southwest region is most seriously affected, followed by the south central region and the eastern region. Generally speaking, it is not too serious in the northern region.

In the distribution over river valleys, acid rain is mainly concentrated south of the Chang Jiang. It can be seen from accompanying Table 2 that cities with precipitation having an average pH lower than 5.6 are almost all south of the Chang Jiang (except Qingdao). The cities with precipitation having a minimum pH less than 4 are all south of the Chang Jiang. This situation is especially obvious in Jiangsu and Anhui. Acid rain in Jiangsu Province mainly occurs in the southern part. According to data from April to July of this year, we can see that the frequency of acid rainfall in Suzhou City reached 66.7 percent, and it reached 83.3 percent in Changzhou City, and in the coal city in northern Jiangsu, Xuzhou, it was only 9.1 percent. Acid rain in Anhui Province mainly occurs in southern Anhui. According to data from May 1982, the frequency of acid rainfall in Anqing Prefecture reached 85 percent, and 35 percent in Maanshan City, and in Hefei City in northern Anhui, it was only 4.2 percent.

(C) The Acidity of Precipitation in Many Regions Is High

In the world, one of the regions where acid rainfall is most serious is the northeastern part of the United States where industry and population are more concentrated. In the mid-1950s, the pH of rain was about 4.5. Now, the pH of rain has dropped to about 4.0, reaching a low of 3.36. Compared to some regions in China, we can see that they also have become one of the regions most seriously polluted by acid rain in the world. It can be seen from accompanying Table 2 that those cities with a minimum pH lower than 4.0 include Suzhou and Guangzhou (3.8), Nanchang and Guiyang (3.7), Chongqing (3.6) and Duyun City (3.1), Guizhou. Especially in Guizhou Province, acid rain has occurred in all of the cities, prefectures and autonomous regions participating in the survey. The average pH of rainfall of the whole province was 5.0, and the minimum pH reached 3.1. It is the most serious among the 23 provinces, cities and autonomous regions. In 1981, the average pH of rain in Chongqing City was 4.6, the minimum value was 2.0. This year, it became worse, since the beginning of summer, acid rainfall has been frequent, and the average pH has dropped to 4.3

To sum up, acid rain in China is very serious. It has become a major environmental problem that urgently needs to be solved.

II. The Damage to Industrial and Agricultural Production by Acid Rain Cannot be Neglected

Foreign nations have published many reports on the damage by acid rain. They generally include the following:

(A) Damage to human health: The toxicity of sulfuric acid smog and sulfate smoke is much greater than that of sulfur dioxide. Because the particles can enter the deep tissues of the lungs and cause pulmonary oedema and hardening of the lungs which will lead to death. According to reports, the toxicity of sulfuric acid smog is 10 times higher that of sulfur dioxide. When the content of sulfuric acid smog in the air is 0.8 milligrams per liter, people will become ill.

(B) Acid rain causes bodies of water to become acidic, and this seriously affects the growth of aquatic animals and plants. In regions lacking sulfate rock, acid rain cannot be neutralized by ground surface matter, therefore the acidity in rivers and lakes rises. In the United States and Canada, there are already several thousand rivers and lakes that have "died" (aquatic animals and plants cannot grow in them), a large portion of the rest is also in danger. The rate of acidification of rivers and lakes in Sweden is dropping by 0.15 in average pH value every 5 years.

(C) Acid rain destroys soil and vegetation. Under the influence of acid rain, such nutrients as calcium, magnesium, and potassium in the soil are leached and dissolved, causing the soil to become more acidic and infertile, which affects the growth of plants. On the other hand, because microorganisms in soil, especially nitrogen fixing bacteria, can only exist in alkaline, neutral or slightly acidic soil, an excessive amount of sulfuric acid will surely cause chaos in the ecological system of the microorganic colonies in the soil, affect the supply of nitrogen and seriously endanger the growth of agricultural crops and other plants. For example, excessive acid rainfall has changed the content of calcium and other alkaline matter in forest soil, reducing the growth rate of the forest. On the Scandinavian Peninsula in northern Europe, the growth rate of forests is slower than normal by 0.3 percent each year. Occurrence of acid rain in Shizuoka and Yamanashi counties in Japan caused the upper leaves of such agricultural crops as eggplant and cucumber to willow and output dropped.

(D) Acid rain erodes metals, paint, leather, textiles and building materials containing calcium carbonate.

In China, destruction by acid rain is becoming more serious, damage to industrial and agricultural production by acid rain continues.

According to reports by the environmental monitoring station in Suzhou City, acid rainfall was heavy (pH 4.7) on 13 May 1982. All of the watermellon vines planted by a certain commune rotted and died and there was no harvest of watermelons. Since the beginning of last summer, because acid rainfall was continuous in Chongqing City, large expanses of agricultural crops withered and died. On 18 June, an acid rain with a pH of 3.9 caused the leaves of some 10,000 mu of paddy rice of a certain commune to rapidly become red, as if being baked, after several days, some of the plants withered and died, and an output of 800,000 jin of rice grains was lost.

Damage to buildings by acid rain also has occurred many times in China. The rate of erosion of metallic materials of the Jianlingjiang Bridge in

Chongqing City, city buses and construction machinery, ships and power transmission lines has increased under the effects of acid rain. The maintenance period and the service life shortened. The exterior decorative materials on new buildings could only remain for 1 or 2 years before decoloration and peeling began. Concrete materials lasted for only 3 to 4 years before the outer layer of mortar eroded and the pebbles were exposed. The cement railings on the sports coliseum in Chongqing City built in 1956 are now pockmarked and uneven, the pebbles are now exposed by more than 1 centimeter. According to time calculations, the cement eroded an average of 0.4 centimeters a year.

It should be pointed out that the effect of acid rain is a slow process, and it is difficult to differentiate it from damage by atmospheric pollution and natural weathering. Therefore, at present, we still cannot quantitatively estimate the loss caused by acid rain, we need to carry out thorough investigation and study. But in the macrocosmic viewpoint, acid rain poses a serious threat to the nation's economic development and we must never neglect it.

III. Causes of Acid Precipitation

Acid rain actually refers to precipitation containing a definite amount of diluted sulfuric acid and diluted nitric acid. The amount of sulfuric acid and nitric acid accounts for over 90 percent of the total amount of acid and the rest consists of some weak acids. In view of China's situation, the amount of sulfuric acid is generally about one-fold the amount of nitric acid and acid rain is mainly sulfuric. Therefore, we should emphasize the study of the formation process of acid rain in the atmosphere by the discharge of sulfur dioxide pollutants.

The formation of acid rain is a very complex process. Because of limited scientific and technical conditions at present, all nations do not have a clear understanding of the formation mechanism of acid rain. It is generally believed that acid rain is mainly caused by the release of sulfur dioxide from anthropogenic sources into the air. It concentrates locally in the atmosphere, and in the process of water condensation, it dissolves to form sulfites and sulfates under catalysis by certain pollutants and then falls to earth with rain water.

Therefore, the formation of acid rain requires certain basic conditions. First, there must be primary material, such as sulfur dioxide or nitrogen and oxygen compounds. They are released by man. When they surpass the diluting and self-cleansing ability of the atmosphere, they concentrate. Second, the atmosphere must have a sufficient amount of oxidizers (such as hydrogen peroxide, or ozone) and catalysists (such as certain industrial pollutants in the atmosphere that have catalytic functions). Third, there must be definite environmental and weather conditions. For example, high humidity and a large amount of rainfall can provide sufficient moisture, gentle breezes and low wind velocity, and definite geographic factors (such as hilly regions), so that the pollutants cannot easily disperse but can easily concentrate.

Table 1. Classification of Acid Rain in 23 Provinces, Cities and Autonomous Regions

First Type (< 45%)

I (0-6%)

Name of province, city, autonomous region	A	B
*Beijing	4%	
Hebei	4%	7%
Jilin	0	0
Heilongjiang	2%	20%
Gansu	0	0
Ningxia	0	0

II (7-13%)

Name of province, city, autonomous region	A	B
Tianjin	7%	25%
Shanxi	7%	8.5%
Nei Monggol	11%	30%
Liaoning	7%	38.5%
Shandong	11%	19.5%

III (14-19%)

Name of province, city, autonomous region	A	B
*Shanghai	14%	
Jiangsu	14%	27%
Anhui	19%	31.5%

Second Type (>45%)

IV (20-40%)

Name of province, city, autonomous region	A	B
Henan	20%	50%
Jiangxi	36%	79.5%
Guangdong	39%	65%
Sichuan	30%	45%

	V > (40%)	
Name of province, city, autonomous region	A	B
Fujian	40%	78%
Guangxi	56%	87.5%
Guizhou	83%	100%
Yunnan	43%	100%
Qinghai	83%	100%

Explanation: 1. Data on Beijing City were gathered from the end of 1979 to the end of 1980; the data on Shanghai City were gathered from 1980 to 1981.

2. A represents the frequency of acid rainfall in each province, city and autonomous region out of the total number of samplings in each of the provinces, cities and autonomous regions;

B represents the number of monitoring stations above the prefectural level which have measured acid rain in each province, city and autonomous region as a proportion of the total number of monitoring stations above the prefectural level in each province, city and autonomous region participating in reporting measurements.

Table 2. Data on Acid Rain in Some Cities in China

Name of city	Time of Measurement	Minimum pH	Maximum pH	Average pH	Frequency of acid rainfall
Beijing	end of 79-early 80	5.28	8.80	7.05	4
Tianjin	82.6-7	4.8	7.5	6.9	7
Shijiazhuang	82.5	7.0	7.0		0
Taiyuan	82.5-7	5.9	8.0	7.6	0
	8	6.5	8.6	7.7	0
Hohhot	82.9	7.4	8.0	7.7	0
Jining	82.5	5.5	6.0	5.8	50
	8	6.4	6.8	6.6	0
Shenyang	82.5	7.3	9.5	7.8	0
	8	3.6	8.6	6.3	16
Dalian	82.5	6.9	7.8	7.2	0
	8	7.0	7.3	7.2	0
Jilin	82.5	6.2	7.5	6.8	0
Changchun	82.5	6.0	7.8	6.8	0
Harbin	82.8	5.8	9.0	6.9	0
Shanghai	80-81	4.02	7.40		14
Nanjing	82.2-6	6.4	7.7	7.0	0

Suzhou	82.5-7	3.8	7.0	5.3	66.7
Changzhou	82.5-7	4.5	6.4	5.1	83.3
Hefei	82.5	5.0	7.5	6.9	4.2
	8	6.0	7.6	6.9	0
Fuzhou	82.5	4.8	6.5	5.4	66.7
Xiamen	82.5	5.5	6.4	5.9	25
Nanchang	82.5	3.7	5.7	4.7	87.5
	8	4.2	6.0	4.8	85.7
Jinan	82.5	6.0	6.7	6.3	0
	8	6.6	6.9	6.8	0
Qingdao	82.5	5.3	5.3	5.3	100
	8	4.7	5.1	5.0	100
Zhengzhou	82.8	7.3	7.7	7.5	0
Guangzhou	82.5	3.8	7.3	5.6	55.6
	8	4.6	6.7	5.5	67
Nanning	82.5	4.1	7.2	5.9	55
	8	4.1	7.4	6.0	24
Guilin	82.5	4.2	6.4	4.9	78
	6	4.4	4.5	4.5	67.5
Chongqing	82.5-7	3.6		4.3	
Guiyang	82.5	3.7	6.5	4.8	81
	8	4.0	6.3	4.6	90
Duyun	82.5	3.1	5.3	4.3	100
	8	3.2	5.4	4.2	100
Lanzhou	82.5-7	7.2	8.2	7.7	0
	8	7.4	7.5	7.5	0
Xining	82.5	5.0	5.5	5.3	100
	8	5.5	6.0	5.6	75
Yinchuan	82.5	6.0	6.0	6.0	0

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NATIONAL CONFERENCE ON ACID RAIN REPORTED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983 p 24

[Article: "National Conference on Acid Rain Forecasting Convenes in Wuxi"]

[Text] In December 1982, the Environmental Protection Bureau of the Ministry of Urban and Rural Construction summoned a national conference in Wuxi City, Jiangsu Province on acid raid forecasting work.

During the convention, the representatives carefully studied and discussed important directives recently issued by leading comrades in the Party Central Committee with regard to environmental protection work, and reported on acid rain pollution in various parts of the country. Based on data recently gathered from provinces and cities, there are evident cases of acid rain pollution in our country which have to be dealt with seriously.

Following thorough discussions, the representatives at the meeting approved technical regulations on acid rain forecasting work, i.e., acid rain [data gathering] points should be distributed as far away as possible from pollution sources, and should not be surrounded by tall trees or buildings which obstruct rain or snow; there should be no less than three data gathering points, and the points should be representative of both urban and suburban areas. The main item to be covered in analysis work is PH value, and it is stipulated in the technical regulations that all provincial/city first-level monitoring stations must perform surveys in February, May, August and November every year. In northern regions, all rains must be tested. The monitoring test results should be reported to the Environmental Protection Bureau of the Ministry of Urban and Rural Construction.

At the conference, it was pointed out that the acid raid forecasts performed in various parts of the country this year were achieved under time-pressing, inexperienced and inadequately-equipped conditions; but they provided training opportunities for people to prepare themselves for future comprehensive and long-term monitoring work, and eventually join the ranks of seasoned workers in this field. The participants at the meeting agreed that acid rain pollution is a multidisciplinary and comprehensive problem which requires high-quality general surveys and monitoring work to be performed though close coordination with meteorological and scientific research organizations. An acid rain monitoring network should be set

up as soon as possible to enable all monitoring points to pool their efforts in finding out the causes, mechanisms and dangers of acid rain, and contribute towards developing reliable measures of prevention and control.

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AREA OF ACID RAIN IN SHANGHAI GROWING EACH YEAR

Shanghai SHIJIE JINGJI DAOBAO in Chinese 31 Jan 83 p 10

["The Municipal Environmental Protection Department Answers Reporter's Questions On the Occurrence of Acid Rain in Shanghai, There Will Be Endless Troubles If the Environment Is Not Taken Into Consideration"]

> [Text] The area of acid rainfall in Shanghai is expanding year after year. The acidity is increasing year after year, but still is not too serious. Up to now, serious damage to crops, land, fish, buildings and health has not been discovered. Yet, if all concerned do not cooperate closely to prevent and control acid rain early, continued development will cause serious consequences. Recently, the Party Central Committee has become very concerned and has issued important directives on this.

[Article by reporter Han Yaogen [7281 5069 2704]]: Recently, Chen Yun and Zhao Ziyang have been very concerned about the occurrence of acid rain in Shanghai and have issued directives on the treatment of acid rain at various times. This has brought about the concern of the city residents in Shanghai. This reporter interviewed the deputy director of the Shanghai City Environmental Protection Bureau, Chen Jiangtao [7115 3068 3447], on this question.

[Question] What is the degree of occurrence of acid rain over Shanghai City? Is the danger great? Where are the polluting sources?

[Answer] The area of acid rain in Shanghai expands as time goes on. The conditions at 13 sampling points show that in 1980, the areas were mainly in Songjiang and Shanghai Counties. In the following year, the area extended to Qingpu and Chuansha Counties and the city limits. Last year, except for Jinshan County, acid rain was frequent at all of the remaining 12 sampling stations. In September, the pH of acid rain measured at most sampling points were between 4.5 and 5.5 (rain with an acidity below 5.6 is defined as acid rain). Even so, the degree of acid rainfall over Shanghai is not too serious. Up to now, we still have not discovered any serious damage to crops, land, fish, buildings or health.

Acid rain is caused mainly by the waste gases of sulfur dioxide. For two consecutive years, acid rain in Shanghai has concentrated more over the three counties of Songjiang, Shanghai and Qingpu. The reasons are complex; further study is needed. Preliminary determination shows that the sulfur dioxide released by the three counties themselves is not sufficient to cause acid rain. It may be caused by sulfur dioxide released by the tall smokestacks in the Shanghai area under specific meteorogological conditions.

[Question] Why is it that Shanghai consumes a lot of fuel, but the acid rain formed at present is still not very serious?

[Answer] The reason found in preliminary analysis is that the sulfur content of the coal and oil appropriated by the state to Shanghai is low. The average sulfur content in the coal is about 1 percent. The sulfur content of the crude oil from Daqing and Renqiu is also low. Thus, the amount of sulfur dioxide released drops and the degree of acid rain is reduced.

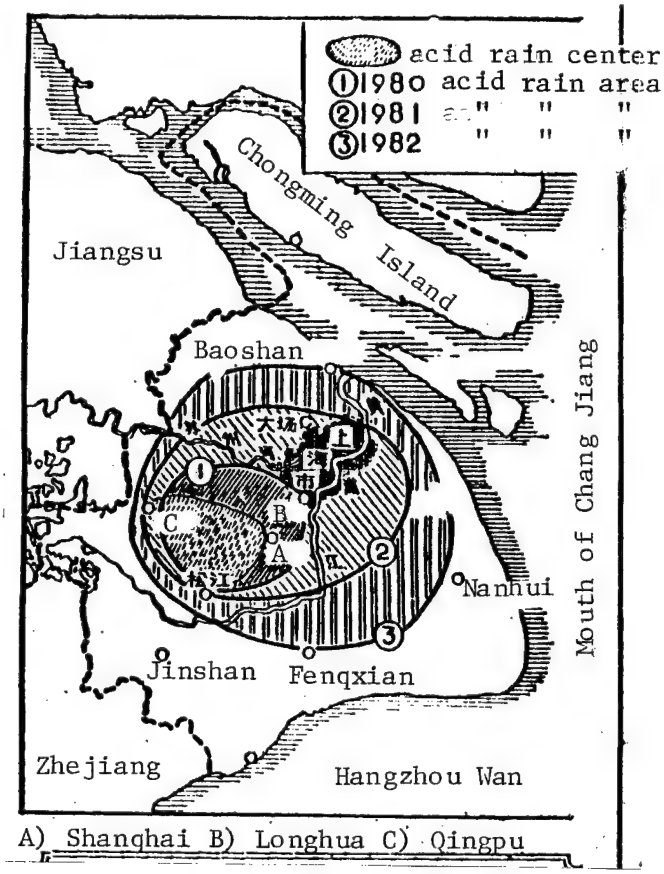
[Question] Is it because of these reasons that damage by acid rain in Shanghai is not considered serious?

[Answer] We cannot regard this as so. Because our means of monitoring are not advanced, therefore the data currently measured cannot completely reflect the degree of damage by acid rain. In view of the fact that the area of acid rain is growing year after year and the acidity is increasing year after year, the problem should attract our attention. According to statistics, Shanghai releases about 300,000 tons of sulfur dioxide and about 140,000 tons of nitrogen oxide into the atmosphere each year. Most of the industrial boilers throughout the city have installed dust removal equipment, but they do not have desulfurizing equipment. In the future, the source of energy will still mainly be coal, and this will surely cause acid rain to increase. In view of this situation, Comrade Chen Yun instructed: "Funds to prevent acid rain must take precedence. Otherwise, there will be endless troubles." On 8 December of last year, Comrade Zhao Ziyang also instructed: "This is a big task, it must be proven, and effective measures must be taken. Our nation is using more and more coal, not taking the environment into consideration will not do. We should have feasible arrangements in long-term plans." Premier Zhao Ziyang also asked the Ministry of Coal to take measures to reduce the sulfur content of coal. The Ministry of Urban and Rural Development and Environmental Protection also came to Shanghai to investigate the situation on orders from the central authorities. These all show that the party and the state are very concerned about environmental protection.

[Question] What considerations have been made by the city's environmental protection bureau about gradually solving the acid rain problem in Shanghai?

[Answer] To us, this is a new topic, and requires further monitoring and scientific research. At present, the preliminary plan that has been drawn up involves three preventive measures: One is that newly built large coal consuming enterprises (especially power plants) must consider installing desulfurizing equipment in smokestacks. Because of restrictions on investment, many newly built units have "reserved a place" for desulfurizing

equipment, awaiting such time when funds become available with the result being that no action is being taken in many instances. Because at present, acid rain in Shanghai is becoming more and more serious, in the future, newly built large enterprises that release sulfur dioxide must be determined to install desulfurizing equipment before acid rain can be controlled. The second is that in the future arrangement of fuel for old enterprises, we should make sure that coal with a higher sulfur content is supplied to those units which have the conditions for installing desulfurizing equipment and units that can implement desulfuration measures in a key way. The third is that we should gradually promote central and integrated heating. This not only conserves coal but it also reduces the number of discharge points, and it actively creates conditions for the treatment of acid rain. Of course, such efforts need close coordination from all sectors before they can be realized.



Area of Acid Rain Over Shanghai Grows Year After Year

Area of acid rainfall
(1) Area of acid rainfall in 1980
(2) Area of acid rainfall in 1981
(3) Area of acid rainfall in 1982

Acidity of rainfall over Shanghai City increases year after year

Year	Least pH	Maximum pH	Average pH
1980	5.12	7.78	6.49
1981	4.67	7.95	6.39
1982	3.92	7.99	5.99

9296
CSO: 5000/4140

DAMAGES BY ACID RAIN INCREASING IN CHONGQING

Chengdu SICHUAN RIBAO in Chinese 11 Mar 83 p 3

[Article by Cai Qi [5591 3825], Sichuan Institute of Environmental Protection: "Emphasize the Prevention and Control of Acid Rain]

[Text] Acid rain is precipitation that has a certain amount of diluted sulphuric acid and diluted nitric acid. Everyone knows that natural rain is slightly acidic, its pH value is about 6-7. Acid precipitation is rain with a pH value less than 5.6. Acid rain causes water and soil to become acidic, directly endangers human health and organisms, damages historic sites and objects, destroys forests and affects the ecological balance. Acid rain has caused severe damage in some areas of our province. For example, between May and June 1982, rainfall in Chongqing was 3.6 to 4.3, tens of thousands mu of rice paddies were affected and more than one million jin of paddies were damaged.

Sichuan's atmospheric pollution is mainly coal smoke pollution; domestic fuel accounts for about one-third of our province's total coal consumption. Fuel used in this sector not only is consumed in large quantity, but also is used in extensive areas and smoke is released at a low altitude. In addition, the Sichuan Basin is humid, rainy, wind velocity is low, and gentle winds are frequent, making it difficult for the air to disperse and providing very good conditions for the formation of acid rain and its harmful effects. Tall smokestacks further away that produce a greater impact and sources of high temperature pollutants discharged into the atmosphere, although not many in number, use more than one-fifth of our province's total coal consumption. Their effect on the acidic level of rainfall cannot be neglected.

At present, scientists believe that acid rain comes mainly from the burning of fossil fuels. But its complex impact and mechanism of transport in the environment still are unknown. What is the present condition of acid rain in Sichuan? What are its special characteristics? How do we prevent and control acid rain? These questions urgently need to be researched further by scientists and technicians.

Acid rain is an environmental problem with extensive impacts; it is also costly to prevent and control. Departments concerned should immediately mobilize their staff to conscientiously research and measure acid rainfall to provide a scientific basis for the prevention of damages brought by acid rain.
12365
CSO: 5000/4149

EMISSION STANDARDS FOR BOILERS NEEDED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983 pp 12-14, 22

[Article by Chen Yanzhong [7115 1750 1813] and Jia Huaiwen [6328 2037 2429]: "Discussion on Formulating 'Smoke Emission Standards for Boilers' in Our Country"]

[Text] Boiler smoke is currently one of the chief atmospheric pollutants in China. Ours is a country with spacious territory, and regions with vastly different conditions; even within the same region, conditions are not entirely the same either. How to formulate national and regional "Smoke Emission Standards for Boilers" has become an issue of wide concern among various places. This paper will briefly discuss some of the underlying ideas, methods and principles involved in formulating the standards.

1. Method for Formulating Standards

Whether one is able to produce advanced and feasible standards largely depends on the type of method employed in the formulation process. Thus, it is imperative to make the right choice. At present, there are three major types of methods in the international community for formulating air pollutant emission standards:

The first method for formulating standards is known as "diffusion model method" and is based on the diffusion pattern of air pollutants, i.e., establish relations between surface density and emission outlet density by computing diffusion models based on surface environmental requirements for supporting human life (atmospheric environmental quality standards or hygienic standards). As this method departs from satisfying environmental quality requirements, to a certain extent, it is advanced and should provide comparatively ideal environmental results. But to a certain degree, it overlooks a techno-economic factor: feasibility, which makes it difficult to implement. Beisdes, in modelling, the selection of parametric values has a tremendous bearing on the outcome. Experts both in our country and other parts of the world hold different views on the modelling technique.

The second method, known as "optimum feasibility technique," is based on studies on currently available techno-economic conditions, i.e., formulate standards through comparison and judgement, and feasibility study within a national or regional boundary on the basis of whatever level attainable through advanced techniques and whatever amount of investment within affordable means. It requires the achievement of optimum results through minimum investment. This method is based on technical feasibility and economic rationality, and can reflect the current objective reality fairly accurately. Once they are announced, the standards can be enforced through a certain amount of effort. To a certain degree, it can control pollution and help improve the environment. Thus, many countries have been using this method in recent years. But, to a certain degree, it can not satisfy special requirements for the protection of environmental quality and falls short of ideal environmental quality.

The third method, known as "total capacity control method," is based on environmental capacity, i.e., determine the emission volume of various pollution sources on the basis of the environmental capacity of various regions, and scatter and reduce pollutant emission in accordance with environmental capacity variations. This method is universally acknowledged to be advanced; but it involves many scientific research projects and entails an enormous amount of work. Moreover, the relation between environmental capacity and emission volume has yet to be explored. Thus, this method is difficult to apply at present.

The authors hold that the formulation of smoke emission standards for boilers should be based on "optimum feasibility technique"; steps should be taken to control or reduce smoke pollution within a limited period of time (such as five or more years) through feasible means, using environmental quality requirements as the objective.

2. Principles for Formulating Standards

The authors believe that the following principles should be observed in formulating smoke emission standards for boilers:

1. Depart from current conditions in our country

In our country, the composition of fuels will still consist chiefly of fuel coal for a long time to come. Thus, coal-combustion smoke pollution control has become the primary concern in the current drive against atmospheric pollution. In view of China's economic situation, it is impossible to raise more funds for changing fuel composition or heating methods. Hence, the chief means of smoke removal now consists of improving combustion efficiency and fume purification through technical innovation.

China's environmental protection workers have achieved a great deal in smoke removal. The broad ranks of technicians and workers of various branches of industry have devised many smoke removal methods which are geared to actual conditions in our country; their achievements include improving combustion mode, designing new types of boilers, and developing

highly efficient smoke removers. These techniques have already been gradually put to extensive application, and have helped to reduce pollution and improve the environment.

Nonetheless, due to the complications involved in the current types of boilers used in our country, plus the extremely poor coal quality, it is unrealistic and unnecessary to enforce the same requirements on different boilers or different regions. Special conditions should be taken into consideration when formulating smoke emission standards for boilers. It is also important to absorb the results of domestic research efforts on combustion mode improvements and new types of smoke removers. We should observe the principles of "optimum feasibility technique," and incorporate multiple requirements. Moreover, while it is necessary to formulate strict standards wherever appropriate, it is equally important to relax the requirements wherever stringent standards are not feasible. Rather than dealing with everything with one sweeping stroke, different conditions should be dealt with differently, and differences in control should be allowed. Efforts should be made to maximize the degree of adaption to current conditions in our country, and thus reach the goal of controlling smoke pollution and improving air quality.

(2) Using environmental requirements as the objective

Environmental quality standards constitute the basis for formulating emission standards, while emission standards are the yardstick for enforcing relevant regulations. The direct function of emission standards is to control smoke pollution and the basic goal is to protect environmental quality. Thus, standards for regulating pollutant emission must embody environmental needs; they should protect environmental ecology centered around the population. If emission standards are formulated purely on the basis of the levels which can be attained by various kinds of boiler products, they will most likely fall too short of the environmental protection requirements. Standards for boiler smoke emission should be formulated on the precondition that environmental requirements are regarded as the objective. Efforts should be made to take into consideration as many types of currently-used boilers in our country as possible, and strive to come up with standards which most boilers within a fairly large territory can meet through measures. Thus, levels that can be reached by current techno-economics are not exceeded at all; moreover, a certain amount of environmental protection is provided.

While environmental requirements should be regarded as the objective in the formulation of emission standards, it is also important to fix maximum-emission allowance values according to different environments rather than looking into each and every kind of boiler. This will provide all kinds of boilers and all kinds of smoke removers with all sorts of possibilities.

Environmental quality standards are overall requirements within a certain range of time and space. But in the final analysis, they are conditional objective values, which, at present, cannot be completely reached under circumstances dictated by a multitude of factors. Thus, by taking

environmental requirements as the objective for emission standards does not mean that all environmental quality requirements can be met in the immédiate period of time; instead, the environmental quality requirements are gradually met through modifications and adjustments of emission standards and values as techno-economic conditions develop.

(3) Implement regionalized control according to different environments

Standard environmental regions should be classified according to the national "Standards for Atmospheric Environmental Quality." But air pollutants have their own particular pattern of diffusion. The air environment of a region is closely related to that of an adjacent region. Moreover, the objects to be protected also have their own political, economic and cultural characteristics.

Based on current environmental conditions in China, there are generally three categories of regions under which boiler smoke emission standards are classified. One category includes natural conservation areas, scenic and tourist spots, convalescent places, ancient relic sites, and areas surrounding important buildings; these are regarded as major protected regions. The second category includes urban districts, suburban areas, industrial zones, and cities and towns above the county level; these are regarded as general protected regions. The third category includes all other areas. Maximum smoke density allowances and maximum Ringelmann density allowances are set according to different regions. Besides the national "Standards for Atmospheric Environmental Quality," the regionalization should also be based on diffusion patterns of pollutants in the air, natural purification capacity of each region, technical level of control, characteristics of smoke pollution, etc. The implementation of the principle of regionalized control embodies the idea of unifying economic results with environmental results, i.e., putting control investments primarily in places where the environment needs to be cleaned up the most and in places where the majority of the population needs protection, and fully utilizing nature's own purification ability in order to achieve more results at low cost.

(4) Encourage the advanced, step up control through enforcement

Besides formulating emission standards and providing legal basis for enforcement of pollution control, it is also important to stress the development of smoke removal work. Although some feasible and effective smoke removal techniques have appeared, and some excellent smoke removal boilers have been designed in recent years, there are not enough applications or improvements throughout the entire country. Moreover, these new techniques also need to be continuously reinforced and improved through use. Thus, another major task in the formulation of emission standards consists of how to bring about even more extensive use of new techniques, new measures, and new equipment, and how to achieve desired results in environmental improvement.

One important means that is widely used among various nations for promoting technical progress and environmental improvement is through the enforcement of laws and regulations. In order to enhance control through enforcement, the standards should include different requirements for the different environmental needs of regions with different functions, and not include any conditions related to combustion mode or boiler type. The purpose is to encourage the advanced and limit the backward. In the case of currently available boilers, in order to obtain permission to use a boiler in a certain region, the smoke emission of the boiler has to meet the standard requirements of the region; if it does not meet the requirements, it will have to be either improved or replaced by a new one. Otherwise, pollution emission fines or other kinds of penalties will be enforced on boilers which do not conform to standard requirements in accordance with relevant laws. The aim is to control pollution sources. Boilers which do not conform to the standards of one category of region but conforms to the requirements of the next category can still be used in the latter. In the case of newly produced boilers, measures should be taken to reduce the boilers' smoke emission density before any attempt can be made to market the products extensively, i.e., the lower the boiler smoke density and Ringelmann density are, the more extensively they can be used. Otherwise, they will either be confined to a smaller range of application or become obsolete altogether.

(5) Integrate environmental improvements with energy conservation

Fuel conservation is at once one of the major measures in China's energy policy and an important means for controlling air pollution. Thus, the formulation of standards should embody the integration of the two beneficial results. Actually, since the day when our country began to develop smoke removers, there have been such requirements as "remove smoke, save fuel, guarantee both production and heat [supply], ensure safety in transportation", placing energy conservation and pollution control on the same level. But smoke removal and energy conservation are not always consistent; when they conflict with each other, coordinative and comprehensive guidelines should be adopted.

The boiling furnace was developed in our country during the late 1960's and early 1970's; its characteristic lies in the ability to burn blended coal wastes. From the viewpoint of energy conservation, this type of boiler can still be used in a few sectors and regions. But this type of boiler requires a lot of investment and accessory equipment; it consumes a great deal of electricity and large volumes of coal waste, ashes and slags have to be shipped. Moreover, it is susceptible to abrasive damages. Its primary smoke emission density, in particular, is as high as over 40 grams per standard cubic meters; even when a 95 percent efficiency smoke remover is employed, its smoke emission still cannot meet the normal requirements. Thus, it has become an object of concern and discussion. A fairly consistent viewpoint is that although this type of boiler is not suitable for urban use, it can still be used in mining districts where coal wastes are nearby and no distant transportation is required. Whether the good points of this type of boiler should be used for serving the four

modernizations construction, and whether it can be used in a certain area--these are one of the major problems in formulating boiler smoke emission standards, which requires consideration of all factors, including both environmental protection and energy conservation.

To solve this contradiction, we think it is necessary to relax the standards for low calorific value fuel boilers used in fuel producing regions, allowing them to exceed the lowest limit of the environmental requirements. This will provide conditions under which the boiling furnace can be used in mining districts, exploiting its advantages to the fullest extent and minimizing its weaknesses. The standards should include regulations on the calorific values of fuels, i.e., relaxed standards for blending a certain amount of coal wastes, and stricter for not blending coal wastes. In other words, preference treatment for energy savers, and restriction for non energy savers. Although some environments may be affected to a certain extent, it will help to further promote the drive to economize on fuels.

The "Smoke Emission Standards for Boilers" are standards for law enforcement of direct control over pollution sources, and involves a very extensive area. The formulation of standards will not only add tremendous impetus to our current efforts to solve the air pollution problems in our country, but also directly affect energy conservation, as well as the designing, manufacturing and use of boilers and smoke removers. Although there is a fairly large scientific basis for this kind of work, some problems have to be further studied and explored. We believe that through the concerted efforts of everyone, this work is bound to develop smoothly.

9119
CSO: 5000/4148

AIR QUALITY IN LANZHOU SHOWS NO IMPROVEMENT

Lanzhou GANSU RIBAO in Chinese 4 Jan 83 p 1

[Article by Ji Xiaoyang [4764 2556 7122]: "Air Quality in Lanzhou This Winter"]

[Text] According to the Gansu provincial environmental protection department, the air quality in Lanzhou this winter is not significantly different from previous years but the average concentration of major pollutants still exceeds the national standard.

Since the beginning of winter many Lanzhou residents have commented that the atmosphere was foggy in the morning and in the evening and the air quality seemed to be poorer than before. This reporter visited the Gansu provincial environmental protection department to look for an answer. Data showed that the average concentration of the major pollutants in the atmosphere this winter in urban Lanzhou is not noticeably different compared to previous years. Major meteorological indicators such as atmospheric pressure and wind velocity are also similar to previous winters, but the humidity (64 percent) was higher than before and the inversion layer was also thicker than previous winters. Because of the high humidity, some of the sulphur dioxide in the atmosphere combined with water and turned into sulphuric acid. When sulphuric acid combines with particles in the atmosphere, it tends to enter the respiratory track and causes lung problems. This combination is more harmful than separate sulphur dioxide and particles. Together with the thick inversion layer, the visibility this winter in Lanzhou was much less than that of previous years, and hence the foggy appearance.

Comrades at the provincial environmental protection departments and other related units have done a lot to reduce air pollution in Lanzhou under a very tight budget, the results are especially prominent in smoke and dust reduction. Before the winter of 1982, departments of Lanzhou municipality devoted a great effort to bring in anthracite and to inspect smoke and dust removal equipment, enabling the air quality to remain stable this winter. But even so, the average concentration of major pollutants, except sulphur dioxide, in urban Lanzhou still exceeds the national standard. This shows that the environmental protection effort can never let up. To solve the air pollution problem in urban Lanzhou once and for all, we should not only treat the symptom but also get to the roots as soon as possible; otherwise, the air quality will deteriorate as the population increases and the city develops.

9698
CSO: 5000/4126

SEVERITY OF BEIJING AIR POLLUTION MEASURED

Beijing HUANGJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 1, Feb 83 pp 36-39

[Article by PAN Gendi [3382 2704 1229] of Beijing Meteorological Center, Central Weather Bureau: "Solar Radiation and Air Pollution in Beijing"]

[Summary] Solar radiation data measured on the ground surface 3 times a day over 22 winters of 1957-79 by Beijing Weather Station, which is located to the southeast of the city, windward of the source of atmospheric pollution, caused mainly by industrial solar radiation from year to year. A general weakening of solar radiation was discovered from the study. The average Linke scale was found to be 3.8 in Beijing, greater than reports of some foreign cities. This indicates the severity of air pollution in Beijing.

6248
CSO: 5000/4154

BRIEFS

JINAN RESOLVES AIR POLLUTION PROBLEMS--While preventing and controlling industrial pollution, Jinan City has broken down the boundaries of various industries to practice integrated and centralized heating; good economic and environmental benefits have been obtained. With the development of industry, the amount of the three wastes discharged has continued to increase, and air pollution has become a major problem in Jinan City. In order to improve the air in the city, central heating was made an important objective of the city's efforts. By the end of last year, central heating had become the reality for the Jinan Light Industry Chemical Plant and Huangtai Paper Mill, the Jinan Branch of Bureau of Railways and the Jinan Railway Station, the Jinan Watch and Clock Plant, the Provincial Construction Industry, the Provicial Bureau of Electrical Power and the Municipal Bureau of Public Health. Central heating was also installed at the Shandong Normal University, the Nanjiao Guest House, the Provincial Committee office building, the Rear Service Department of the Provinical Military District, and the five buildings of the Jinan Garrison Headquarters. This measure has four advantagaes: (1) Energy resources are conserved. The nine heat supply points will save more than 6,000 tons of coal a year. (2) Air pollution is alleviated. The nine points retired 35 small boilers of less than 2 tons in size and removed 30 smokestacks so that the number of pollution sources is reduced. (3) Capital investment and the number of workers are reduced, 93 boiler attendants are no longer needed. (4) Production is promoted. Recently the Municipal Government resolved to establish a Heat and Power Production and Construction Command Post to further develop and accelerate the pace of central heating. [Text] [Jinan DAZHONG RIBAO in Chinese 27 Mar 83 p 1] 6248

CSO: 5000/4153

DANGERS TO AGRICULTURE OF BORON POLLUTION HIGHLIGHTED

Tianjin NONGYE HUANJING BAOHU [AGRICULTURAL ENVIRONMENTAL PROTECTION] in Chinese No 1 1983 pp 3-5

[Article by Shang Shouyan [0794 1108 1484], Shaanxi Provincial Environmental Protection Institute and Zheng Zequn [6774 3419 5028], Xi'an Municipal Institute of Agricultural Sciences: "Dangers to Agriculture of Boron Pollution"] *

[Text] Many countries include boron content among their water quality standards. Among their standards for irrigation water quality, boron control criteria are particularly stringent. China's existing water quality standards, however, do not yet contain these criteria. As a result, when problems with boron pollution are encountered, environmental pollution departments and affiliated departments do nothing about solving them for lack of arbitration standards. Boron pollution of the shallow ground water layer in the Yan River district of Xian is a good example. When boron pollution of the shallow ground water layer was first discovered in 1963, it covered an area of only a few score mu, but by 1979 it had spread to an area of more than 7,700 mu in a period of 16 years (on the basis of the boron content of the shallow ground water layer being greater than 1 milligram per liter). Use of boron contaminated shallow layer ground water as a source of irrigation water caused widespread damage to farmlands. Over the years grain and vegetable crop yields declined, and serious pollution completed aborted the harvest. Production losses totaled more than 300,000 yuan. In order to elucidate the reasons for the pollution, we made a study between 1978 and 1980 of the effects of boron contamination on the farmland ecological system in that district (via irrigation water to soil to crops). The results show an extremely close relationship between the concentration of boron in irrigation water and growth and development of farm crops. Where boron was lacking, the role

Comrades Li Bingjun [2621 3521 6874], Bian Shuping [6708 3219 5493] and Liu Xiulan [0491 4423 5695] participated in the experimental work.

of irrigation water containing low concentrations of boron in increasing crop yields was pronounced. Excessive amounts of boron, on the other hand, caused severe damage to farm crops. The range of concentrations of boron that benefit, inhibit or damage crops is very narrow, and farm crops differ greatly in their resistance to boron. Consequently, control of boron concentrations in irrigation water is extremely important in guaranteeing increased farm crop yields. For this reason, it is suggested that control standards for boron be increased in China's current (trial) standards for farmland irrigation water.

1. Damage to the farmland ecological system caused by too much boron.

1. The source of boron contamination is boron muck that is a mixture of waste residues and waste water resulting from the production of chemical products containing boron such as boric acid and borax. When these materials are thoughtlessly discharged into rivers or buried in the ground, the boron they contain percolates into the ground water (the shallow ground water layer, and the same applies subsequently in this article) in the form of water soluble boron, spreading pollution as it flows.

We preliminarily explored the reasons for the spread of water soluble boron in ground water, and concluded that when water soluble boron exists in the forms of a boric acid radical ($BO_3^{=}$), a meta-boric acid radical ($BO_2^{=}$), and a tetra-boric acid radical ($B_4O_7^{=}$), the shallow ground water layer has a maximum boron concentration of 37.4 milligrams per liter. When negative boron ions at such a high concentration pass through fissures in the soil to flow into the ground water, the adsorbtive function between grains of soil is very weak and very few of them are adsorbed by the soil as colloids. When six different concentrations of boric acid solution ranging from 5 to 30 milligrams per liter were used in an experiment on soil adsorption, the amount of adsorption was the equivalent of 0.62 - 2.31 milligrams per kilogram, while the amount of cadmium that the soil adsorbed reached the equivalent of 120.9 milligrams per kilogram, a difference of 50 to 200 times. Thus, the movement of boron in ground water far surpasses that of the heavy metal cadmium. Once boron contaminates ground water, it will quickly percolate into the ground water and spread with it, steadily increasing the contaminated area.

2. Damage to farm crops from high concentrations of boron in irrigation water.

Boron is an essential trace element for farm crops, but when irrigation water contains too much boron, exceeding the limits

that crops can tolerate, the damage caused to yields is no less than from other pollutants. Observations made over a period of 3 years on the growth and development of 12 farm corps in boron contaminated areas shows the following: When irrigation water boron concentrations were from 3.7 - 11.1 millimeters per liter, damage was noticeable and yields severely reduced or aborted. The same 12 crops grew normally in non-contaminated areas where the irrigation water boron concentration averaged 0.4 millimeters per liter (Table 1).

Table 1. Crop Growth and Development in Boron Contaminated Areas and Control Areas

Boron Contaminated Area				Non-contaminated area		
Crop	Boron Content of Irrigation Water mg/l	Water Soluble Boron Content of Cultivated Layer of Soil mg/kg	Crop Growth Situation	Boron Content of Irrigation Water mg/l	Water Soluble Boron Content of Cultivated Layer of Soil mg/kg	Crop Growth Situation
Chives	5.4	5.96	Yellow-brown roots;withered and died		0.12	
Winter squash	5.4	9.65	Leaves yellowed few squash and small in size		0.69	
Tomatoes	5.4-11.1	11.30	Leaves yellowed, stunting, and entire plant died		0.04	
Onions	7.6	8.70	Leaves yellowed; and onions only as big as walnuts		0.17	
Scallions	5.4-11.0	9.30	Leaf tips yellowed; and growth halted		0.34	
Chilli Peppers	5.4-11.0	7.60	Yellow mottling of leaves which curled		1.15	

			0.0-0.4	Normal
Egg-plant	5.4-11.0	8.75	Purple skin mottled brown	0.91
Cucum-bers	5.4-10.0	7.55	Leaf yellowing; young shoots stopped growth; cucumbers lop-sided; withered and died.	0.22
Wheat	4.0	3.90	Leaf tips yel-lowed; old leaves withered, and little tillering	0.43
Corn	3.7	3.60	Distinct yellow edge around green leaves; much balding and premature wither-ing	0.66
Cab-bage	5.4-11.0	5.50	Many leaves turned yellow and brown	1.23
Pota-toes	5.4	5.50	Seedlings died or did not reproduce	1.33

The range between boron concentrations that benefit or damage farm crops is extremely narrow. We used water of different boron concentrations in experiments with the growing of mei [2734] beans in pots containing soil from uncontaminated vegetable garden plots. The boron concentrations used were 0.1, 0.5, 1.0, 2.0, 5.0, 7.0, 10.0, and 15.0 milligrams per liter respectively, watering being done a total of seven times in the course of the growing season, a total of 6.2 liters per pot used. As a control, a boron concentration of 0.1 milligrams per liter was used for watering. The results showed that when a concentration of from 0.5 - 2.0 milligrams per liter was used, yields definitely increased. When 3 milligrams per liter were used, damage caused by yellowing of the green leaves occurred early on. Use of 5 milligrams per liter produced clear damage and yields began to drop. When more than 10 milligrams per liter was used, yields were only half that of the control, and plants withered and died prematurely. (Table 2)

Table 2. Effects of Different Concentrations of Boron in Water on Yields of Mei Beans

Boron concentration in water used for watering mg/l	0.1	0.5	1.0	2.0	5.0	7.0	10.0	15.0
Average mei bean pod yield . Grams per pot	11.34	11.70	13.46	11.56	10.54	9.86	6.38	6.28
±(g)		+0.36	+2.14	+0.32	-0.30	-1.48	-4.96	-5.06
Percent	100.0	102.2	113.9	102.0	93.0	86.4	56.3	55.4

Cucumbers were most sensitive to too much boron. When boron concentrations were 2 milligrams per liter, the damage was apparent, all the leaves yellowing. Boron accumulation in leaves increased noticeably becoming 2.14 times higher than in the control plants. The accumulation of boron in the cucumbers became 2.12 times higher than in control plants. When boron concentrations of 5 milligrams per liter were used to water plants, all the leaves yellowed, and prematurely withered and died.

2. Differences in boron resistance of various crops.

1. Observations made at more than 10 boron contaminated crop growing areas and experiments with the growing of plants in pots showed a very great difference among farm crops in their resistance to water containing boron. Cucumbers and pulse crops were extremely boron sensitive. Concentrations of more than 2 milligrams per liter of water produced noticeable damage to them. White radishes, however, were still able to grow when the water's boron content was 10 milligrams per liter. This shows, in general, that cereal crops (wheat, corn, and paddy rice) have greater resistance than vegetables, and among cereal crops, wheat's resistance is greater than corn's. Resistance of vegetable crops in descending order was as follows: white radishes andcabbage

greater than eggplant; bell peppers and onions greater than winter squash; tomatoes greater than potatoes, and potatoes greater than mei beans and cucumbers.

In some foreign countries, water quality standards for farmland irrigation provide different boron standards depending on the boron resistance of individual crops. In the United States, for example, a distinction is made among boron standards for fruit trees, cereal grain crops, and vegetables, and amounts are further defined as excellent, good, fair, poor, and impossible for each of the three categories for a total of 15 standards. The overall principle is that maximum boron concentrations for water to be used on grain crops is generally lower than that for vegetables. Results of our research showed just the opposite, namely that maximum permissible boron concentrations for water to be used on vegetable crops was generally lower than for grain crops. This result was based on observations and measurements of crops grown in open fields and experiments with plants grown in pots, which unanimously showed the boron resistance of cereal crops to be greater than that of vegetables. Furthermore, vegetables require large amounts of water during their growth, and the total amount of water provided them was vastly greater than for grain crops. In the central section of Shaanxi Province, for example, the wheat was watered three or four times during its 240 day growing season for a total of about 100 cubic meters per mu. Meanwhile, tomatoes were watered 17 to 18 times during their approximately 210 day tomato growing season for a total of 680 cubic meters or more than five times as much as for wheat. Given identical boron concentrations, the total amount of boron retained in the tomato plant soil environment was also more than five times as high as in the wheat soil environment. Therefore, under ordinary circumstances, the maximum permissible concentration of boron in water for vegetables should be lower than for cereal crops. When water with boron concentrations in the range of 1 millimeter per liter was used on more than 10 crops observed in open fields or pots, nothing out of ordinary occurred. In most of the water quality standards of foreign countries too, boron concentrations are held at 1 millimeter per liter. On this basis within the farmland irrigation water quality standards being tried in China that the boron standard be increased to a general maximum permissible concentration of 1 millimeter per liter.

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PREVENTION, CONTROL OF PESTICIDE, FERTILIZER POLLUTION

Tianjin NONGYE HUANJING BAOHU [AGRICULTURAL ENVIRONMENTAL PROTECTION] in Chinese No 1, 1983 pp 23-25

[Article by Li Wenmou [2621 2429 5399] and Chen Liangbi [7115 5328 1732], Heilongjiang Provincial Academy of Agricultural Sciences: "Prevention and Control of Pesticide and Fertilizer Pollution in Heilongjiang Province"]

[Text] 1. Present Status of Pesticide and Fertilizer Use in the Province.

In 1958, Heilongjiang Province used 4,000 tons of pesticides. The amount rose to 13,500 tons in 1970 and suddenly increased in 1980 to 23,162 tons of 30 different varieties. This included 15,000 tons of insecticides, which accounted for 65 percent of all pesticides, and which were mostly in the form of benzene hexachloride, DDT, trichlorfon, dichlorvos, dimethoate, and phoxim; 572 tons of bactericides accounting for 2.5 percent of the total and including copper sulfate, kitazin, chlorothalonil, ethylene bisdithiocabamates, carbendaxol, and carboxin; and 1,516 tons of herbicides accounting for 7 percent of the total and including 2.4 D butyl ester, propanil, nitrofen, prometryne, benthiocarb, and trifluralin. The area in the province treated with pesticides in 1980 was 80 million mu or 62 percent of the total cultivated area, and insecticides were used on 60 million mu of this area. In 1952, pesticide use for the province as a whole converted to raw pesticide terms was 0.4 grams per mu; by 1980, it was 57.7 grams, a 144 fold increase.

In 1980, 1,606,300 tons of chemical fertilizer were used throughout the province, 2.6 times as much as in 1970. This included 839,900 tons of nitrogenous fertilizer, 393,000 tons of phosphate fertilizer, 50 tons of potash fertilizer, and 373,300 tons of compound fertilizer. Chemical fertilizer was used on 65 million mu or 50 percent of the province's cultivated land area. Almost two-third was nitrate fertilizer, the most commonly applied kinds being urea, ammonium sulfate, ammonium nitrate, ammonia water, ammonium bicarbonate, calcium superphosphate, potassium sulfate, potassium chloride, and compound fertilizer.

2. Farm Pesticide and Chemical Fertilizer Pollution and Harm

Farm pesticides and chemical fertilizers have played a fine role in the prevention and control of crop diseases, insects, and weed pests, and have increased output. However, because of overuse and improper methods of using farm pesticides and nitrogenous fertilizer on some fields, pollution of crops, the soil, and the atmosphere have resulted. According to the Provincial Bureau of Agriculture and the Provincial Commercial Inspection Bureau,monitoring results on 68 varieties of six different crops, namely wheat, corn, soybeans, paddy rice, millet, and gaoliang grown at monitoring sites with a history of benzene hexachloride use as a pesticide showed 57 varieties to contain residual benzene hexachloride, for an 83.8 percent discovery rate. Eight of them, or 11 percent, had amounts greater than provisional national standards (0.3 ppm); 46 of them or 70 percent had amounts greater than United Nations standards (0.05 ppm), and 68 varieties contained four different isomers of benzene hexachloride, namely methyl, ethyl, propyl, and butyl at a maximum 1.03 ppm and an average 0.16 ppm. Among grain crops, wheat and gaoliang's residual organic chlorine content was 20 time more than United Nations standards and three times higher than China's provisional standards. Vegetables from Haerbin contained residual benzene hexachloride radicals as high as 32 ppm (when the provisional national standard is 0.2 ppm). Random sampling of hogs, cattle, and sheep done in 1980 by the Food Institute showed an average 0.07 ppm of benzene hexachloride and 0.3 ppm of DDT, both of which were more than stipulated standards.

After spraying crops with insecticide, 20 percent of the insecticide adheres to the surface of the plants, and enters the plants through their epidermises. The remaining 80 percent either enters the soil or is dispersed into the atmosphere, only to fall again with rain and enter the soil. Some places mix pesticides directly into soil, husks, or manure, which they scatter on the ground. This pollutes the soil and is absorbed directly by plants. Some pesticides flow into rivers with runoff to pollute aquatic organisms, and go through the biological chain to become concentrated in human bodies. Pesticide harm to humans stems mainly from contaminated livestock products and foods, from beverages, and from breathing. Food accounts for 95 percent of the residual pesticides that enter the human body. Sixty percent of the chemical pesticides currently in use in Heilongjiang Province are highly residual organic chlorine pesticides (such as benzene hexachloride and DDT) whose chemical properties are stable, which do not breakdown in the presence of sunlight or micro-organisms, which have low volatility, are highly soluble in oils, do not dissolve well in water, and readily build up in human fatty tissues leading to pathological changes in the human liver,

kidneys, nerves, and blood, or even affecting reproductive genes, giving rise to deformed fetuses, and cancers. Reportedly fatty tissue in Americans contains 0.4 ppm of benzene hexachloride, in Germans 0.45 ppm, and in Indians 1.70 ppm. In China, people from Shanghai have 9.64 ppm, from Beijing 5.67 ppm, and from Zhejiang Province as much as 20.29 ppm. In 1979, the Haerbin Municipal Health Quarantine Station measured the amount of benzene hexachloride in 20 patients and found residual amounts of between 0.8 and 7.9 ppm in 19 of them, an average of 3.27 ppm per person.

Chemical fertilizer contamination of crops and livestock, as well as the harm it causes humans is frequently overlooked. Statistics from the United Nations Food and Agriculture Organization shown that in the 7 years between 1961 and 1977, average world use of nitrogenous fertilizer per hectare of cultivated land increased 2.6 times. The United Kingdom, the United States and Japan have reported that the rapid increase and improper use of nitrogenous fertilizer has led to water pollution, which has caused large outbreaks of enterogenous cyanosis in infants. When drinking water contains nitrate nitrogen greater than 40 ppm, it is harmful. In Heilongjiang Province, the nitrate content of some vegetables is high, exceeding the standard several fold. Because fertilizer has been used for a long time, the soil has become hardened and impervious and has changed its physical properties. Bodies of water have become rich in nutrients, increasing the amounts of nitrates, nitrogen, and nitrites in them. Under certain conditions carcinogenous nitrosamines may be produced that become dangerous to both humans and livestock animals. Use of large amounts of nitrogenous fertilizer also makes vegetables taste bad, their quality inferior, and their keeping properties poor. Nitrogenous fertilizer's low utilization rate is the main reason pollution is created. Reportedly the nitrogenous fertilizer utilization rate is 41 percent in the USSR, between 30 and 50 percent in the United States and Bulgaria, between 43 and 56 percent in Yugoslavia, 50 percent in the United Kingdom, between 50 and 70 percent in East Germany, between 50 and 60 percent in Japan, between 40 and 60 percent in each of the countries of Southeast Asia, and between 27 and 45 percent in China. Therefore, reduction of nitrogen loss, improvement in the nitrogenous fertilizer utilization rate, and making the most of the role of chemical fertilizer in increasing output are important ways in which to reduce pollution. Studies show that major ways in which nitrogen loss leading to environmental pollution occur are as follows: (1) Ground surface runoff such as results from drainage of farmland, scouring by torrential rains, and soil erosion; (2) Dissipation in the form of gas. In the process of transporting or spreading nitrogenous fertilizer, loss through volitalization in the form of ammonia gas occurs. Within 3 days after applying ammonium sulfate, usually a loss of about 7 percent of its nitro-

gen occurs. For ammonium bicarbonate, the loss is 10 percent. In the largely anerobic state of ricefields that are irrigated with water for long periods of time, nitrogen in the form of nitric acid, which has been formed through nitrification, is readily carried away in water, and the nitrogen monoxide and nitrogen produced by counter nitrification enter the atmosphere. This loss accounts from about 40 to 50 percent of the total volume of nitrogen. (3) Nitrates and nitrites are carried away with surface water to enter reservoirs and streams or to percolate through the soil to enter ground water. About 10 percent of the amount applied is washed away in this way. (4) Additional loss occurs when the fertilizer is not applied at the proper time, when absorption of moisture during storage causes deliquescence, through breaking of bags when transported, and scouring by the wind in arid areas.

3. Technical Measures for Prevention and Control of Pollution

1. Rational Use of Existing Pesticides

(1) Improvement in pesticide application anerobic state of ricefields that are irrigated with water for long periods of time, nitrogen in the form of nitric aurn so that shortcomings of one kind of pesticide will be compensated by the strengths of another, thereby effecting a combination of control and increased effectiveness. In places where pesticide pollution and pest resistance to pesticides has already occurred, pesticides should be changed and ill-advised increases in the amounts of pesticide that add to pollution avoided.

(2) Accurate understanding of the number of times pesticides should be sprayed, the times when they should be sprayed, and the concentrations to be used. Pesticides should be used scientifically on the basis of the times of occurrence of diseases, insect pests and weeds, their characteristics, and the extent to which they cause damage. In this way, costs may be lowered, pesticide effectiveness increased, and pollution diminished. In addition, the spacing of pesticide sprayings (the safe waiting period) should be properly grasped in terms of the kind of pesticide being used, the method of its application, the crops on which it is being used, and weather conditions in order to assure that once crops have been harvested, residual amounts of pesticide within them will not be more than standards permit.

2. Improved new pesticide preparations

Use of granular pesticides to replace dusts or liquids that are sprayed and readily pollute the environment could reduce pollution. Alternatively, use of pesticides in capsules (slow acting pesticides) permits high effectiveness from the use of small

amounts of pesticide, low toxicity, slight residual toxicity, and safety for humans and livestock.

3. Processing to remove pollution

Most contaminants lodge in grain husks and embryos, and some of them can be removed through careful processing of the grain. Pesticides that remain on the surface of vegetables and fruits may be removed by soaking them for 24 hours. Alternatively, an alkaline hydrogen peroxide solution or a weak potassium hydroxide solution may be used to wash residual pesticide from vegetables, fruits, and livestock feed, and followed by rinsing in clear water. Cooking at high temperatures or under high pressure is yet another effective way in which to reduce residual pesticides.

4. Development of harmless pesticides

(1) Development of new, highly effective, low toxicity, low residual toxicity pesticides to replace gradually pesticides of high toxicity and great stability. Examples include use of organic phosphorous and organic nitrogen pesticides such as trichlorfon, dimethoaote, phoxim, fenitrothion, malathion, carbaryl, and tsumacide to replace organic chlorine benzene hexachloride, DDT, and mercuric pesticides. Chlordimeform for prevention and control of insect pests such as rice stem borers, monocrotophos and methamidophos for prevention and control of aphids and mites, thiophanate and carbendaxol of fairly wide applications, and carboxin, which have been developed in China in recent years, are all new pesticides of high effectiveness, low toxicity, and low residual toxicity.

(2) Use of gyplures and various kinds of hormones to prevent and control insect pests. Most important are gyplures, juvenile hormones, and metamorphizing hormones.

(3) Chemical preparations that prevent conception (sterility preparations). In foreign countries, male insects are irradiated causing them to lose their ability to procreate so that successor generations cannot be produced.

(4) Use of botanical preparations. Botanical pesticides are safe for humans and livestock, are not toxic, and do not pollute the environment. They include substances such as pyrethrum, tobacco, and trifoliate jewelvine [Derris trifoliata]. Pyrethrum pesticides such as bromocyano-chrysanthemic esters readily decompose are highly effective in pr evention, have no residual toxicity, and do not pollute the environment.

(5) Study of micro-organisms for biological prevention. This consists largely of using insects to control insects, using bacteria to control insects, and using bacteria to control bacteria, i.e., use of pathogenic micro-organism preparations that are safe and non-toxic for humans and livestock to kill insect pests, the production of which is simple and inexpensive, and that can be easily spread. An example is the use in Heilongjiang Province of trichogramma for the prevention and control of cornborers over a 500,000 mu area for more than 60 percent effectiveness, and at a cost of only 0.16 yuan per mu; the spread to an almost 8 million mu area of baijiangjun [4101 0304 5497] to control cornborers for an 80 percent effectiveness rate, and at a cost of about 0.15 yuan per mu; the use of granular viruses to prevent and control vegetable green worms and small vegetable moths with 90 percent effectiveness; and the use of antibiotics such as blastocidin S and kasugarnycin, which have also been applied rather widely.

5. Scientific use of chemical fertilizer to increase the utilization rate and prevent pollution

(1) Deep fertilizing with nitrogenous fertilizer. Experiments have shown that deep fertilization with nitrogenous fertilizer can increase soil adsorption of ammonia ions and reduce nitrification, thereby diminishing runoff and the dissipation in gaseous form of nitrogen, dinitrogen oxide, and ammonia produced by counter nitrification. When ammonium bicarbonate penetrates the soil to a depth of 3 centimeters, between 7.07 and 42.3 percent of its nitrogen is lost. However, when it is applied deeply to a depth of 10 to 15 centimeters, there is virtually no volitalization and loss. Therefore, when nitrogenous fertilizer in an ammonium state is applied to dryland fields, it should be applied to depth of more than 6 centimeters. Experiments conducted by the Soil Fertility Institute of the Heilongjiang Provincial Academy of Agricultural Sciences show that when urea is applied to a depth of 10 centimeters, its utilization rate is between 15 and 20 percent higher than when spread on the surface of the ground, and grain yields increase between 4.6 and 16.3 percent. In wetlands, when nitramine is applied to a depth of 8 to 10 centimeter, nitrogen loss is reduced by 22 to 25 percent as compared with surface application.

(2) Coordinated use of nitrogenous fertilizer and other fertilizers. When ammonium sulfate was applied alone to soils lacking in phosphorous, its utilization rate was only 25 percent, but when spread in conjunction with phosphate, its utilization rate rose to 52 percent, a 27 percent increase. When ammonium nitrate alone was applied to corn, its utilization was only 25 percent, but when combined with guoshi [6665 4258] possibly calcium super-

phosphate , the utilization rose to 46 percent, a 21 percent increase.

(3) Use of nitrification inhibitors. These are able to control the nitrification and counter-nitrification of nitrogenous fertilizers, thereby reducing runoff and volitilization for an increase of about 30 percent in the utilization rate.

(4) Use of slow acting fertilizers. Use of fertilizers enclosed in capsules causes slow release of fertilizer effectiveness for a reduction in loss and pollution.

6. Adoption of multiple measures for prevention and control of which agricultural prevention and control are paramount.

Strengthening of plant quarantine and disease and insect pest monitoring and reporting work; good field care (rational farming and crop rotation, scientific fertilization, and weeding, plowing, and banking of soil around growing crops); eliminating sources of diseases and insect; and growing of disease- and insect-resistant varieties.

To summarize the foregoing, the pollution in Heilongjiang Province that use of pesticides and chemical fertilizers has occasioned is serious, and must arouse a high degree of serious concern. In this regard, it is necessary to implement conscientiously the "Environmental Protection Law," do a good job in the province of surveying the background values in the agricultural environment and monitoring pesticide residues, while at the same time going about research and agricultural environmental protection and monitoring work.

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NATURAL PURIFICATION OF SEWAGE SEEN BENEFICIAL IN IRRIGATION

Tianjin NONGYE HUANJING BAOHU [AGRICULTURAL ENVIRONMENTAL PROTECTION] in Chinese No 1 1983 pp 16-18

[Article by Zhang Wanzhang [1728 5502 4545] in Chinese, "Full Use of Natural Purification Role to Increase Economic Effectiveness of Sewage Irrigation"]

[Text] 1. Situation and Problems Existing in China's Sewage Irrigation

China's sewage irrigation area has increased rapidly during the past several years. March 1982 statistics show its use over an area of more than 10 million mu. The main reason for such rapid development during the past 2 years has been the severe drought that gripped many parts of the country in recent years. Not only north China, but many parts of well-watered south China experienced water shortages as well. A 1981 meeting of 10 southern cities on water usage convened jointly by the State Construction Commission and the State Economic Commission noted the following: The 10 cities are currently short of 2.12 million tons of water daily. As a result of the serious drought in Tianjin during 1981 and the resultant dirth of water that placed extremely conflicting demands on water use, agriculture had no choice but to use large amount of sewage to irrigate the fields. Very clearly good performance in sewage irrigation is not only a matter of prevention and control of water pollution, but is also a major problem bearing on industrial and agricultural production and on the relationship between industry and agriculture. It is also a major problems bearing on the people's livelihood. Formerly people appreciated only that the "energy" crisis damaged industrial and agricultural production. They did not realize that the potential seriousness of a "water" crisis was greater than that of an "energy" crisis. In cities where water is used in a concentrated way, the crisis was particularly apparent. Under such circumstances, urban sewage became one of the main sources of water for agricultural production in the suburbs. At the present time, more than 90 percent of China's urban sewage is not treated in any way. Under such circumstances how can pollution not occur when

sewage is diverted to the irrigation of farmland, happen what may? Pollution in some parts of sewage irrigation areas has become serious. In more than 11 places, cadmium pollution has reached the point at which "cadmium rice" is being produced. Japan has set the minimum cadmium content of soil to produce "cadmium rice" at 1.5 milligrams per kilogram, but in China more than 160,000 mu already surpass that standard. In Japan maximum cadmium contamination of the soil is 109.2 millidgrams per kilogram, but in Yangshuo Prefecture in China's Guangxi Province, the soil's cadmium content has reached 130 milligrams per kilogram. Though this contamination is partial, pollution has become rather serious. In individual communes in Yangshuo Prefecture, a small number of commune members have come down with symptoms of the third stage of "bone pain illness," which shows that the time has come when pollution just must be solved.

2. Full Use of Natural Purification In order to Control Pollution

Though sewage irrigation has resulted in serious pollution, pollution has occurred only in some areas, not all of which are sewage irrigation areas. This has been enlightening. Why is it that sewage of identical quality has polluted in some cases but not in others? If the reason could be found, effective measures for controlling water pollution could be found. Experiences everywhere had a single point in common, and that was that pollution occured in irrigation areas close to the sources of pollution in which sewage had not been treated before use in irrigation. Conversely, no pollution or very light pollution occurred. This was a law of sewage irrigation, and if this law could be mastered, by bringing industrial sewage under control, by diverting urban sewage a certain distance from sources of pollution, by purifying the sewage in oxygenation ponds and reservoirs before using it to irrigate the fields, the disadvantages of using urban sewage could be avoided and the advantages capitalized on. Not only could the goal of controlling water pollution be attained, but its positive role in helping production could be brought into play.

When the subject of urban sewage purification is raised, some people are prone to think of building urban sewage treatment plants with first, second, and third stage treatment, rather than realize the powerful purification potential of nature. Our studies during the past several years show natural purification to have three main components. One is the purification role of sewage canals; a second is the purification role of oxygenation ponds and reservoirs; and the third is the purification role of

farmland. If these three components are applied in a scientific way, fairly decent treatment results can be attained.

Let us talk first about the purification role of sewage canals. Once sewage has been discharged from the pumping station, it undergoes changes of various kinds as it flows along the canals. This is the natural purification role of the canals, and this natural purification role is a combination of physical, chemical, and biological roles. Usually the heavy metal content of sewage in canals is fairly high when the sewage leaves the pumping station, and the heavy metal is moved along with the water in the canals. In the process of moving, suspended matter acts as a carrier for poisonous heavy metals, and after they are adsorbed, their ratio increases. This hastens the settling of the poisonous heavy metals. Generally speaking, the heavy metal content diminishes rapidly in the upper reaches of the canals. In the middle part, the settling slows, and in the lower part, the settling becomes stable. The settlement rate for different poisonous heavy metals also varies, and is closely related to the nature of the sewage. In places far from the sources of pollution, where oxygenation ponds should be constructed for sewage irrigation, general methods may be adapted to differences in water quality. Organic poisons like phenol and cyanogen are largely broken down in the canals. We have not yet studied in sufficient detail the natural purification function that goes on in the sewage canals, and deepgoing study is necessary. Just how the natural purification role of sewage canals can be made to function to the maximum may be said to be one of the main points for future study in prevention and control of pollution.

Second is the natural purification role of oxygenation ponds and reservoirs. The use in recent years of oxygenation ponds (or reservoirs) for purification of urban sewage has attracted increasingly serious attention. By 1976, the United States had 5,500 oxygenation ponds for the purification of urban sewage, and in the USSR, Canada, and Sweden, the use of oxygenation ponds in the treatment of sewage also saw definite progress. In China use of oxygenation ponds (or reservoirs) for the purification of sewage for use in irrigating farmland is done at the Fenghui Canal sewage reservoir irrigation district of Xian; at Xisanjiao Production Brigade in suburban Shijiazhuang, where oxygenation ponds purify sewage for field irrigation; and at the sewage reservoir in Qiqihaer to which "sewage is diverted to clean up the Nen River." Practical experience everywhere has shown that oxygenation ponds have a remarkable capacity for purification. In general, the longer the sewage is kept in the ponds (or reservoirs), the greater the purification. In an experiment conducted at Xisanjiao Production Brigade, for example, when sewage was held in a single pond for 6 hours, the poison removal rate was

8.8 percent for phenol, and 6.3 percent for cyanogen. When held 3 days, the poison removal rate changed to 68.6 percent for phenol, and 69.9 percent for cyanogen. When water hyacinths and algae, which provide oxygen to the water, were grown in the ponds, their purification effectiveness increased strikingly. For water held in such ponds for 4 hours, the cyanogen removal rate was 64.3 percent. In four stage continuous oxygenation pond containing algae at the Hubei Hydrobiology Institute, treatment of sewage containing 4 parts per million of mercury eliminated 94 percent of it when the sewage was held in the pond for 24 hours. Experience has told us that full use of the purification role of oxygenation ponds (or reservoirs) can produce treatment results the equal of two stage treatment.

Third is the role of farmland in purification. Farmland purification includes purification of both the soil and farm crops. The soil contains large number of micro-organisms, which serve in the physical, chemical, and biological breakdown of toxic substances suspended in sewage. Even nitrates and phosphates, which are difficult to remove in two stages of treatment, change into sources of fertilizer that farm crops need when they reach the fields. Analysis done in Shijiazhuang shows that sewage irrigation can remove 98 percent of the phosphates and 86 percent of the nitrates in sewage, and eliminate 100 percent of viruses as well. It is precisely because of this special function that sewage that has been purified in oxygenation ponds (or reservoirs) is best used to irrigate the fields, with little or no discharge into a body of water. This both helps agricultural production and does not pollute bodies of water, thereby turning a disadvantage into an advantage.

Though farmland is remarkably effective in purification, if the toxic content of sewage is greater than the capacity of farmland to handle it, pollution may likewise occur. In some places where totally untreated sewage has been used to irrigate farmland, serious pollution has already occurred. Consequently China should not refer to its sewage irrigation and oxygenation pond (or reservoir) purification and treatment systems as soil treatment systems. When some foreign countries refer to soil treatment, they mean soil treatment after secondary treatment has become common. This is a different situation than the one that exists in China. In China not only has secondary treatment not become common, even primary treatment is not common. Under these circumstances, advocacy of soil treatment very easily leads to misunderstandings. If ill-conceived diversion of totally untreated sewage to field irrigation is termed soil treatment, this will be extremely bad for development of sewage irrigation.

In summary, natural purification is an organic whole composed of

the foregoing three integral parts. Only when they are effectively used in combination can purification effectiveness be ideal. In that case, why is it that purification results are remarkable from some oxygenation ponds (or reservoirs) and poor from others? The fundamental problem is failure to master fully the laws of natural purification. In order to effectively improve the effectiveness of natural purification, a certain amount of manpower and material resources must be concentrated for deep study, with emphasis particularly on the scientific combination of the foregoing three parts.

3. Economic Benefits From Full Use of Natural Purification of Sewage for Field Irrigation

After full use has been made of natural purification conditions to purify urban sewage, its use becomes a way of using little investment for good results that appear quickly and can be readily spread, that conserves energy, increase production and protect the environment, which is suited to China's circumstances. It is a form of sewage treatment that uses the natural biological cycle to replace a man-made biological cycle. Given China's present technical level, the building of man-made biological treatment plans would require a capital construction investment of about 250 yuan per ton of sewage. Since China discharges about 80 million tons of sewage daily, a capital construction investment of about 20 billion yuan would be required. Figuring a cost of 0.10 yuan for each ton of sewage treated, 8 million yuan would be required daily for the treatment of the nation's sewage. Thus, 2.9 billion yuan would be required for the whole year. In terms of energy consumption, 4.38 billion kilowatt hours of electricity would be needed annually. Not only can the country not afford such an energy burden, even in capitalist countries, such a method of treating sewage raises doubts. Therefore, there is no choice but to use soil treatment systems in place of three stage treatment to solve the problem of pollution of freshwater resources. Even today some people in China advocate building of man-made biological treatment plants to solve the problem of sewage pollution. Practice is the sole criterion for testing truth, and the results of practice are that man-made biological treatment plants have not been built and natural biological purification has been held in low esteem with the result that China's river system has become seriously polluted causing inestimable losses to the aquatic products industry. As a result of a water shortage in numerous places, the use of totally untreated sewage to water the fields has caused varying degrees of pollution to the agricultural environment. If this situation continues, future consequences are too terrible to contemplate. In order to solve the country's sewage pollution problems, we must urgently cry out loudly, proceed from the country's existing economic condition

and actively begin study of the natural purification and treatment of urban sewage and its multiple uses in order to eliminate pollution, to protect the environment, to increase production, and to benefit the health of the people. We must run practical pilot project, and use facts to convince the masses so that the route of natural purification of urban sewage becomes the practice of the broad masses of people for solution of China's sewage pollution problems. Then, within a not too long period of time, the environmental protection program that the country has long proposed calling for "all-around planning, rational distribution, multiple uses, turning disadvantages into advantages, reliance on the masses, everyone taking part, environmental protection, and creating prosperity for the people" can be realized.

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DISCUSSION OF BASIC CONCEPTS IN SEWAGE IRRIGATION

Tianjin NONGYE HUANJING BAOHU [AGRICULTURAL ENVIRONMENTAL PROTECTION] in Chinese No 1 1983 pp 14-16

[Article by Zhao Ziding [6392 1311 1353], Wang Lijuan [3076 7787 1227] and Liu Baoxiang [0491 1405 4382]: "Discussion of Several Basic Concepts in Sewage Irrigation Surveys"]

[Text] Tianjin is a well-known industrial and commercial city as well as an international entrepot that has more than 4,000 industrial enterprises and a population of more than 7 million. It annually discharges about 400 million tons of industrial waste water and household sewage, one-third of which is used in agricultural irrigation and two-thirds of which is discharged into Bohai via two large sewage canals to the north and south of the city. In addition, Beijing annually produces about 370 million tons of mixed sewage, which is also discharged into Bohai after passing through three counties and two districts of Tianjin via the Beijing sewage canal. The serious shortage of water resources that has existed ever since the mid-1960's and that has obstructed development of agricultural production has resulted in sewage becoming a precious source of liquid fertilizer for Tianjin. The area irrigated with sewage has rapidly expanded reaching about 2.23 million mu by 1979.

As a result of a 1978 - 1980 survey, the city's three major farmland areas irrigated with sewage were divided into the southern sewage canal irrigation zone, the northern sewage canal irrigation zone, and the Wubaoning sewage irrigation zone for convenience in future planning, monitoring, and control. In the processing, surveying,and mapping of the irrigated area in each of these irrigation zones, some fundamental problems requiring integration were encountered. The first was what does sewage irrigation mean. How many kinds of sewage irrigation are there? What is meant by pure sewage irrigation, clear and mixed sewage irrigation, and intermittent sewage irrigation? How can some confusion of concepts be distinguished, such as under what circumstances is soil called polluted stream irrigated soil? Or polluted soil of industrial origin? We have presented below for

discussion by comrades concerned the actual situations encountered and the zoning methods used in the course of our work.

Sewage irrigation of farmland. All farmland to which mixed urban sewage is diverted as the farming season requires (i.e., a mixture of industrial waste water and household sewage) is termed sewage irrigated farmland. Large scale use of mixed sewage for farmland irrigation began in Tianjin in 1958. Individual districts of the city such as Jizhuangzi began sewage irrigation as early as 1949, but on a small scale. With completion of the building of the locks on the Hai River in 1958, tidal conditions on the river changed, and saline and freshwater were kept separate. During that same year, the southern sewage canal and the northern sewage canal were opened to the south and north of the Hai River. This ended the discharge of sewage into the Hai River, clear water and sewage flowing away through different channels. This was a project that had substantial affect on the city's environment. With the acceptance by these two sewage canals of the city's mixed sewage, irrigated farmland reached 326,000 mu. The Beijing sewage canal traversed all of Wuqing County and the Baodi, Ninghe, northern suburbs, and Tanggu districts of the city. This formed the Wubaoning sewage irrigation zone centering on sewage irrigation of all of Wuqing County, an area of 1.91 million mu. The foregoing 2,236,000 mu irrigation area was established on the basis of the sewage irrigation concepts we had formulated.

Because the amount, the number of times, and water quality all differ, effects on the environment and consequences of sewage irrigated soil are manifestly different. Therefore, different kinds of zoning are necessary. On the basis of the city's different circumstances, we zoned a pure sewage irrigation zone, a clear and mixed sewage irrigation zone, and an intermittent sewage irrigation zone.

Pure sewage zones. Farmland that is irrigated entirely with sewage year-round without the introduction of clear water is called pure sewage irrigation farmland. The farmland located along the southern sewage canal and irrigated from the drainage trunk line at Youhoutaizi, for instance, is a fairly representative example of sewage irrigation farmland where sewage irrigationhas been going on for more than 20 years. In addition to diversion of sewage for irrigation, this farmland is characterized by frequent simultaneous use of sludge, much of which accumulates in the upper reaches of the canal and along its shore. The suburban area area irrigated with pure sewage accounts for only 2.6 percent of the total area. In the Wubaoning sewage irrigation zone,however, the pure sewage irrigation area along the shores of the Beijing sewage canal accounts for 30.9 percent

of the area. In this zone, 590,000 mu of farmland are irrigated solely by the diversion of sewage. This situation is a direct result of the serious shortage of water in recent years. In this type farmland, the accumulation of heavy metals in the soil is pronounced. This is because the lay of the land is flat in Tianjin; there are few slopes, and sewage canals flow slowly. This favors the precipitation and purging of heavy metals. In the upper, middle, and lower reaches of the sewage canals, the heavy metal content of the water and the bottom mud is exceptionally pronounced. This must inevitably result in the appearance of notable accumulations of some heavy metals in the diverted sewage zones and in the soil of pure sewage irrigation zones that apply bottom mud to the fields. Cadmium, mercury, copper, and arsenic have appeared in varying degrees of concentration in cereal grains. Consequently pure sewage irrigation farmlands are currently a focus for monitoring and study.

Mixed clear water and sewage irrigation: Farmlands on which clear water and sewage are mixed or used alternatingly are called mixed clear water and sewage irrigation farmlands. Tianjin has 1.16 million mu of mixed clear water and sewage irrigation farmland, or almost one-half the area irrigated with sewage. This is the main form of sewage irrigation in Tianjin. In the southern sewage canal sewage irrigation zone, in particular, 97 percent of the area uses this form of. Liqizhuang, Fucun, Wangwenzhuang, and Dasi communes have been using mixed clear water and sewage irrigation for more than 20 years, and are the areas of the city with the longest history of sewage irrigation. The speed of build-up of heavy metals in the surface layer of the soil is lower in mixed clear water and sewage irrigation zones than in pure sewage irrigation zones.

Intermittent sewage irrigation: All farmland that practices winter irrigation or that diverts sewage for irrigation during the crop growing season is called intermittent sewage irrigation farmland. Such farmlands use clear water sources for the most part, or a mixture of clear water and sewage, principally industrial sewage. In sections of rivers where water quality is poor, some areas have difficulties getting either clear water or sewage. Tianjin has 470,000 mu of intermittent sewage irrigation farmlands. This is about one-fifth the total sewage irrigated area. Heavy metals build-up in the surface layer of the soil is slow in intermittent sewage irrigation farmlands, and there is no build up of mercury, zinc, or arsenic.

Because sewage irrigation methods differ, the amount of sewage that enters the soil differs greatly, and consequently the speed with which toxic substances enter the soil and their total amount also differ. Different forms of sewage irrigation produce diffe-

rent effects on the environment. A survey of the total area of sewage irrigation area without survey of a survey of the different forms of sewage irrigation and their distribution would not reflect the environmental situation objectively, nor would it make possible an accurate evaluation of the present state of irrigation zones. This is the environmental significance of and necessity for this type survey of sewage irrigation.

In the course of the sewage irrigation survey, some concepts that were regularly confused were the following: The amount of contaminants in soils irrigated by polluted streams and in soils contaminated by industrial sources differed not only in quantity from contaminants in soils irrigated with sewage, but definite differences in quality existed as well. The nutrient content of mixed urban sewage was fairly plentiful, and the kinds of toxic substances contained in it were also numerous. Their cooperative role, antagonistic role, and complexing role are far from known. Their physical adsorption, chemical adsorption, and physio-chemical adsorption by organic and inorganic compounds once they enter the soil is even more complex. As compared with soils irrigated from polluted streams and soils contaminated by industrial sources, soils irrigated with urban sewage have somewhat fewer contaminants, but frequently the degree of contamination by a single contaminant is serious. Analysis is provided below.

Soil irrigated from polluted streams: Any farmland that has been irrigated by waters diverted from streams containing a single or multiple pollutants is termed soil irrigated by polluted streams to distinguish it from soil that has been irrigated with sewage. Frequently such streams do not function to discharge pollutants, and when the source of wastes they do discharge is cleaned up or moved, water quality improves. Farmland on which pollution of the soil occurs as a result of irrigation from polluted streams (no matter whether from single or frequent irrigation), and on which pollution of crops occurs, no matter whether acute toxicosis, chronic toxicosis, or no apparent toxicosis, cannot be termed sewage irrigated farmland. Below an actual example is taken from Tianjin to illustrate. In 1974, wheat in 40,000 mu of wheatfields became contaminated with trichloroacetaldehyde as a result of diversion of waters of the Ji Canal. An acute case of toxicosis occurred that resulted in abortion of the wheat harvest over a fairly large area. This was primary pollution, and the contaminated wheatfields positively could not be classed as sewage irrigation farmlands. Another instance took place in Ji County where the Zhou River became polluted with wastes from a paper making plant. When the river was diverted to irrigate 150,000 mu of farmland, several thousand mu of soil was polluted in varying degrees. But the Zhou River's function is to carry clear water, and with control of the Ji County Paper Plant, water

quality can be improved. Therefore, though the river frequently polluted the farmland that was irrigated, it could not be classed as sewage irrigation farmland.

Polluted soil from industrial sources: The waste gases, waste residues and waste water discharged by certain industrial plants or industrial areas strongly pollute surrounding farmlands resulting in soil that is obviously polluted, which is called soil polluted by industrial sources, soil polluted by water quality, soil polluted by waste residues, or soil polluted by a combination of sources. Depending on the extent of pollution, various degrees of pollution may be assigned in the course of an evaluation. Farmlands in which crop growth was seriously affected and where crop failures resulted has been classified as industrially polluted farmland in Tianjin. Farmland polluted by discharge of waste water from industrial sources should also not be classified as sewage irrigation farmlands.

It should also be explained that not all farmlands to which mixed sewage has been diverted for irrigation should be classed as sewage irrigation farmlands. Farmlands that are not continuously sewage irrigated should also not be classed as sewage irrigation farmlands. For example, in 1981 a serious drought occurred in Tianjin. The ground water table dropped tremendously, and riverbeds dried up. During the period of "grain fills," around 5 May when a survey was done, it was noted that in all areas where conditions permitted, clear water rivers were the first to be used for the diversion of sewage, and sewage was diverted to the irrigation of a substantial area that had formerly been irrigated with clear water. These farmlands likewise cannot be classed as sewage irrigation farmlands; however environmental records might bear the notation that because of severe drought in 1981, sewage was diverted to them for irrigation on several occasions.

In discussing the effects of various kinds of irrigation on pedological and botanical systems, this article has distinguished between quantity and quality. In the study of environmental quality and the history of environmental pollution, such distinctions are necessary. However, this conceptual distinction is relative rather than absolute. In matters of this kind, mutual relationships and mutual points of similarity exist, and this too is unavoidable. In summary, various types must be classified on the basis of the characteristics of the local area and through adaptation of general methods to local situations in order to reach the goal of expressing relatively precisely the state of a local area's sewage irrigation environment.

9432

CSO:5000/4146

WARNING AGAINST USE OF SEWAGE FOR IRRIGATION ISSUED

Shijiazhuang HEBEI RIBAO in Chinese 29 Oct 82 p 2

[Article by Wang Guoying [3769 0948 5391], Shijiazhuang City Environmental Protection Office: "Prohibit the Use of Toxic Wastewater for Irrigation of Vegetables," with editorial postscript]

[Text] Currently the area of cropland irrigated with sewage in Shijiazhuang City has reached 40,000 mu. Most of this is wastewater from the chemical engineering, paper-making, textile printing and dyeing, cotton spinning, coking and hospital departments and household sewage. Every day a total of 730,000 tons is discharged, of which only 24 percent meets standards. Most of this water is untreated, and in addition to containing nitrogen, phosphorus, potassium and trace elements needed for plant production, it also contains large amounts of harmful complex substances which can do great harm to crops, soil, and subsurface water; this should receive serious attention from the relevant departments.

As a result of prolonged sewage irrigation, the subsurface waters in the irrigated areas have been directly or indirectly polluted. In the high-water season, six areas have phenol contents in excess of the standards, with an average concentration of 0.0061 mg/liter (the drinking water standard for phenols is a maximum of 0.002 mg/liter). Cyanide pollution is most serious in the southeastern part of the city, with a maximum concentration of 0.07 mg/liter and an average concentration of 0.0125 mg/liter (the drinking water standard is a maximum of 0.01 kg/liter of cyanide compounds). Chloride ion, acid radicals and total hardness increase steadily from north to south, and cyanide compounds and bacteria are more numerous in the southern section. The bacteria detected are primarily localized; all places with excessive levels occur in the southern section of the city, except for the wine-making area.

When the content of harmful materials in the sewage exceeds permissible soil self-purification levels, these materials may accumulate in the soil. If certain accumulation levels are exceeded, plant growth and development may be hindered, the quality of crops may decline, and harm to humans and livestock may even result. Many heavy metal materials included in this class are different to break down; they may accumulate in plants to produce residual toxicity or may pass through the food chain and harm human health.

In addition, once this type of soil pollution occurs, it is very difficult to eliminate. Judging by soil conditions in the sewage-irrigated areas, increases in the quantities of phenols and cyanide compounds are tending to produce soil pollution. Soils in some of the sewage-irrigated areas contain as much as 14.63 mg/kg of arsenic, which constitutes mild pollution. The cadmium content has also been increased by sewage irrigation.

The vegetables required by the inhabitants of Shijiazhuang are supplied by six communes on the outskirts of the city. Chemical analysis of the vegetables on the market indicated high pollutant levels in those sold at Yuhua Lu, Zhongshan Lu, Chang'n Lu, Nanma Lu and Hedong; the average cyanide content of various vegetables from various sewage irrigation areas was at the "trace pollution" level, and there were various degrees of heavy metal pollution in the various sewage-irrigated areas.

The results of monitoring and analysis of all market tables in 1980 and 1981 indicate that Chinese cabbage, spinach and cucumbers had levels of cyanide compounds, arsenic and cadmium higher than the initial pollution values and contained "trace pollution" levels everywhere. In order to assure the quality of vegetables, wastewater which has not undergone stringent treatment and does not meet agricultural irrigation water standards must not be used for irrigation, and in particular must not be used on vegetables.

The older peasants in the sewage-irrigation areas say that sweet potatoes from these areas do not soften during cooking, rice from Xisanjiao has an unusual taste, eggplants and tomatoes irrigated with sewage when they have just fruited are likely to rot, and garlic watered with sewage rots. Surveys indicate that the cancer death rates in Tazhong Brigade of Suncun Commune and in Tangu Commune are rising.

Under current conditions irrigation with sewage is of some importance for making the fullest use of water resources. But it should be subjected to strict management and control. Accordingly, we make the following suggestions:

(1) Wastewater control work should be intensified. We should require that all plants gradually refrain from discharging wastewater exceeding pollution standards in order to improve the wastewater quality.

(2) There should be a special management body for wastewater treatment and utilization, a unified management system should be developed and oversight and management should be strengthened. Where conditions permit, the establishment of municipal wastewater treatment areas should be considered.

(3) Strict control should be exercised over the types of crops watered with sewage. Since such crops as melons and greens are particularly subject to pollution, all irrigation of these with sewage should be prohibited.

(Excerpted from QINGKUANG FANYING, published by the provincial scientific and technical information research institute.)

[Editorial postscript] We Must Control Sewage Pollution

Sewage treatment and utilization are an important matter affecting the people's lives and health. As a result of analysis and study of a large amount of data, Wang Guoying of the Shijiazhuang City Environmental Protection Office has pointed out the gravity of the sewage irrigation problem in Shijiazhuang City and has made some reasonable suggestions for sewage management and control. We hope that they will receive serious attention from the relevant departments.

Sewage irrigation is currently still of some importance, but we must intensify monitoring and control so that untreated sewage will not be discharged and sewage which does not meet water quality standards will not be used for irrigation, and in particular will not be used on vegetables, in order to protect the people's health.

8480
CSO: 5000/4121

SATELLITE PHOTOGRAPHY'S VALUE IN CHARTING ECOSYSTEMS ILLUSTRATED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983 pp 44-46

[Article by Ma Hongliang [7456 7703 5328] and Xi Minmin [1153 2404 2404], Geology and Geography Departments, Lanzhou University: "Application of Remote Sensing Techniques to the Study of Arid Area Agro-Ecologies"]

[Excerpts] Use of a combination of aerial photographs, satellite photographs, and on the ground surveys made over a period of time on arid and semi-arid area agro-ecosystems and the ecological equilibrium is a method that is both economical and quick, and also one from which highly accurate results may be obtained in study of ecological changes.

This article uses several actual cases of studies in the Hexi Corridor and the loess highlands as examples to provide a briefing, with emphasis on the interpretive analysis of remote sensing pictures backed up by on-the-ground verification.

1. Changes in Oasis Conditions in the Hexi Corridor

Both photographs and on-the-ground observations show that changes that have taken place in the Hexi Corridor's agro-ecosystem have been determined by changes in water conditions. As Figure 1 shows, places traversed by streams are oases. Examples are where the Shiyou River curves westward into the Huahaize Basin, and the curve to the east of the Duanshaokou River. This circular shaped configuration is the vestige of an ancient lake. History has recorded that the Huameizi Basin was once the location of the Hanmin Lake and the Tangda Lake, which the ancients reported as totaling 260 kilometers in length from east to west and 50 kilometers in width. This was the largest lake in Hexi. During the Qing dynasty, it became a salt lake after the amount of water in it declined greatly. Today these lakes have dried up, but around them a small earth-tone rim remains visible (where cotton is grown). Most of the soil is desertified saline soil or desert soil. For example, the modern day Duanshankou River flows into

desertified saline soil. Examples of desertification in the Hexi Corridor that have been brought on by changes in water sources or the drying up of water sources are numerous.

Figure 1. Sketch Map From Readout of Satellite Photograph of Huahaizi Basin

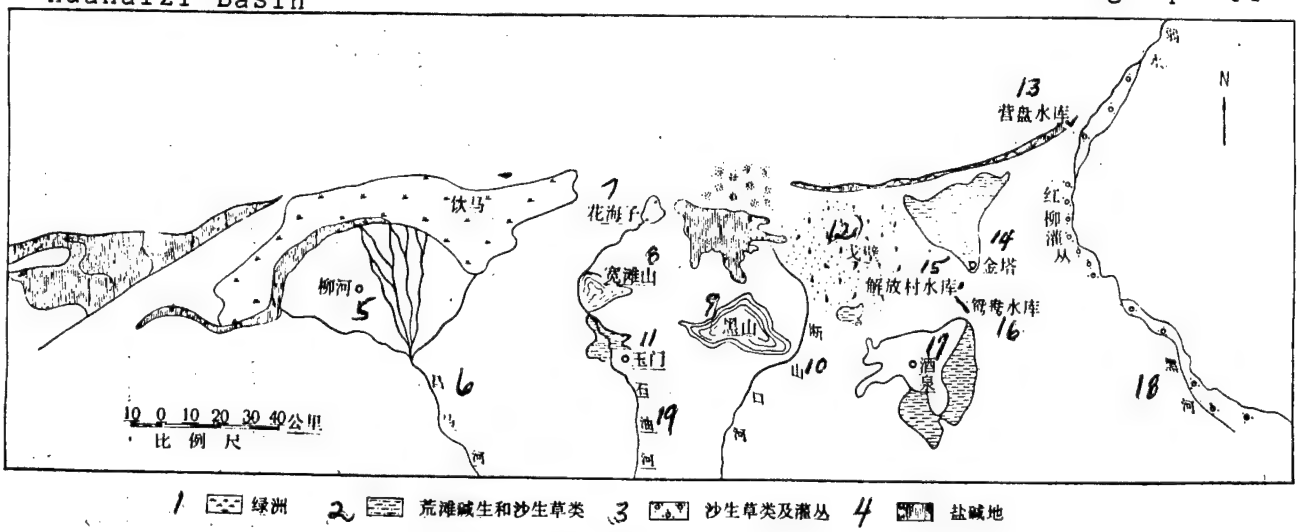


图1 花海子盆地卫星象片判释示意图

1. Oasis
2. Wasteland flats where grasses that tolerate alkalinity and sand grow.
3. Sand tolerant grasses and clumps of scrub
4. Saline-alkaline soil
5. Liu He
6. Changma River
7. Huahaizi
8. Kuannan Mountain
9. Hei Mountain
10. Duanshankou River
11. Yumen
12. Gobi Desert
13. Yingpan Reservoir
14. Jinta
15. Jiefangcun Reservoir
16. Yuanyang Reservoir
17. Jiuquan
18. Hei River
19. Shiyou River

It is worth noting that trends toward change of water resources are frequently reflected first in lakes, which are highly sensitive to change. As is shown in Figure 2 (a satellite photograph), the dark image in the center is Suguonuoer Lake. On 1 December 1972, the lake's surface covered 61 square kilometers. The dark color in the middle of Figure 3 (a satellite photograph) is also Suoguonor Lake, whose surface covered about 38 square kilometers on 28 April 1975. The two satellite photographs were taken 2 years, 4 months and 28 days apart during which time the lake's surface hadshrunk by about 23 square kilometers. While these changes were taking places, Juyan Hai (saline), which had always been carried as having an area of 650 square kilometers, and

which is shown as a long, white oval shape on the left of the satellite photograph (Figure 4), had already dried up. The sharp region wide decrease in the amount of water in this arid area, its extent, and its great effects are rather astounding. Figure 5 shows date obtained on Koko Nor from remote sensing photographs and ground observations. Between 1968 and 18 April 1979, Koko Nor's surface has fallen in a straight line by 1.7 meters resulting in a large decrease in water fowl. A 1978 survey showed 3,000 mottled head geese [2432 7333 7159] nests as having been built there. The following year there were 1,000-odd fewer. In 1978, there were 4,000 large sea gull nests, but fewer than 2,000 the following year. Figuring an average of seven birds per nest, in 1979, there were more than 30,000 birds less.

Figure 2. 1 December 1972 Photograph of Suoguonuoer Lake

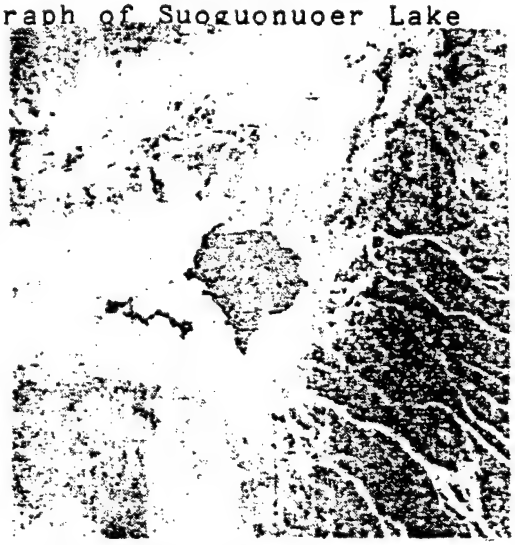
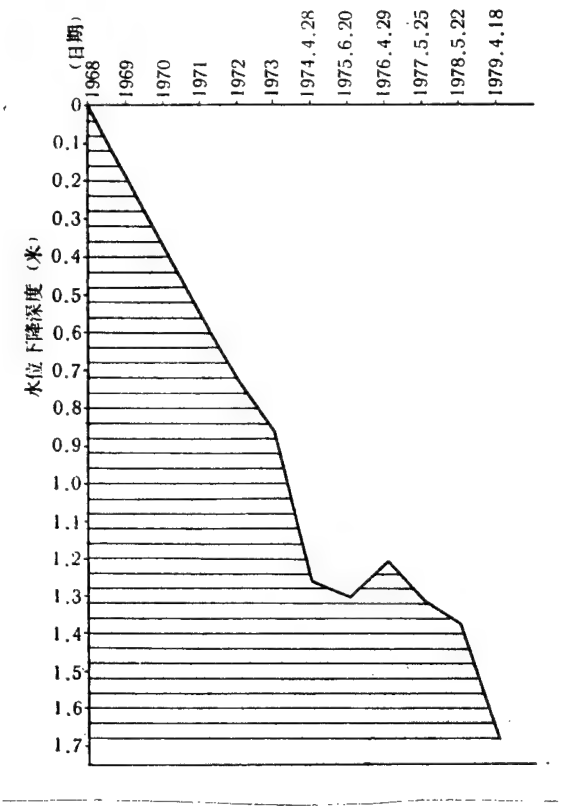


Figure 3. 28 April 1975 Photograph of Suoguonuer Lake

Figure 4. Satellite Photogrxaph of Juyan Hai

Figure 5. Graph Prepared From Satellite Photographs and Ground Survey of Water Level in Koko Nor



Key:

1. Depth of Drop in Water Level
2. Date

(1) Observation and Analysis of Remote Sensing Photographs of the Wuwei Prefecture Agro-ecosystem

Wuwei Prefecture is located in the eastern part of the Hexi Corridor, and has six counties including Xiajingtai, Tianzhu, Gulang, Wuwei, Minqin, and Yongchang. Its land area totals about 47,000 square kilometrers. Such a vast area is just the place on which to use macroscopic satellite photographs. Overall observation of satellite photographs shows that the prefecture may be divided into three distinct ecosystems as follows:

1. The Southern Qilian Mountain Ecosystem

Inasmuch as the southern Qilian Mountain Ecosystem is at an elevation of from 2,000 to 4,800 meters above sea level, atmospheric precipitation is about 607.8 millimeters (in the northern Qilian mountains, it is only 160.6 millimeters). In addition, since humidity is higher in forested areas than in non-

forested areas, forested areas having 15 to 20 percent higher humidity than non-forested areas, rainfall in forested areas is 16 to 30 percent higher than elsewhere. Therefore use of seven wave band satellite photographs and false synthetic color satellite photographs produced better results in making observations. In seven wave band satellite photographs, imagine tones become noticeably deeper. Most coniferous forests show up as particularly black images on synthetic color satellite photographs, showing this area's special natural landscape. Thus it has been dubbed the area of convergence of the white reservoir (glacier), green reservoir (forests and grasslands), and ground water. However, in recent years, ecological changes have been marked in the Hexi area, particularly the ecology of Wuwei Prefecture. These changes have caused serious damage to the ecosystem, which has been manifested in the following ways:

(1) Destruction of forests and clearing of the land for agriculture. This is shown in Figure 6. We used a 1:500,000 satellite photograph taken on 29 September 1976 to draw a sketch map showing destruction of forests in Qilian Mountain in Weuwei Prefecture. Comparison with data acquired through conventional means in 1960 shows an area of more than 300,000 mu of forest to have been destroyed. Because of the increasingly small forest area, the volume of rivers has fallen year by year, and erosion has become serious. At the same time changes in the snow line are also quite apparent. For example, snow accumulations on Maomao Mountain are clearest only on four wave band satellite photographs, second clearest on five wave band, and not visible at all on seven wave band photographs.

(2) Burning of mountain. Though the burning of mountain grass raises ground temperature, it also destroys the fertile grasslands and soil structure, and burns up large amounts of organic material and nitrogen, leading to serious erosion. Once the grass has been burned off of mountains, reflectance becomes strikingly lower than from grasslands. On seven wave bank satellite photographs, burned over areas appear in dark tones. When a reflection projection device was used on a 1:1,000,000 satellite photograph to blow it up to about 1:800,000, results were striking. Observation shows the burned mountain area to be most serious in the high mountain farming regions of Tianzhu, Gulang, and Wuwei counties.

(3) Building of reservoirs and small coal mines. The satellite pictures show construction of numerous reservoirs in the southern Qilian Mountain region. Five of the seven medium size reservoirs in the region are located in the Qilian Mouontain region. Where reservoirs have been built in forested areas, the ground cover has been destroyed. Mines in the Qilian mountains have also

oasis agriculture area, and this has also caused changes in moisture conditions. Comparison of aerial and satellite photographs of the Jinchuan - Changning irrigation area over a period of time show very great differences in color tones. This is precisely the area with a large density of wells and where the water table is declining seriously.

(2) Serious effect of reclamation and cultivation on farming areas in the lower reaches. Use of standard false color synthetic pictures (MSS_4, MSS_5, and MSS_7, which were pictures printed in yellow, magenta, and blue) were quite useful in making observations. These showed that clearing of land for agriculture, building of sites, and cultivation of fields one after another was rather common in Jingtrai, Gulang, and Yongchang counties. In Yongchang County, there formerly had been fine natural grasslands with plants and flowers, but the satellite photographs showed brown and black images for numerous fields that had been reclaimed, some of them (and fairly large areas too) very geometrical. Comparison of aerial and satellite photographs of the sandy wasteland in the area of Minshanzui in Gulang county showed a 20 percent increase in the wasteland area as compared with the early 1960's, and a halt in agriculture throughout the entire area.

3. The Northern Desert Ecosystem

The northern desert ecosystem is the most fragile of the three kinds of ecosystems. It includes mostly the Gobi, sandy desert areas, low mountains, salt marshes, and desert steppes. Readouts from satellite photography on this area showed the following: an increase in saline and alkaline lands, retraction of ground cover, and a return of shifting sands. Remote sensing photographs also discovered further sources of water.

(1) Shifting sands. Because of deterioration of the ecology in mid and upper reaches, which has brought about a water shortage in the lower reaches, the role of ground cover in blocking sands has diminished and the movement of shifting sands is gradually swallowing up oases. Figure 7 shows comparison of aerial and satellite picture data. In 1959, sand dunes were still a certain distance away from oases; however, satellite photographs show that sand dunes have advanced fairly markedly in recent years. The Zhongliu flatlands in Minqin, for example have undergone serious desertification, and sand dunes have already swallowed up more than 200 meters of those flatlands, and are advancing at a rate of 8 meters annually. The satellite photographs show definite laws operating on these sand dunes. Since they are composed of fresh dry sand, the fairly stable sand dunes are highly reflective and they show up as light tones on the photographs.

2. Central Corridor Oasis Ecosystem

Because it is an area of irrigated agriculture, the central corridor oasis ecosystem includes mostly irrigated agriculture, and man-made forests, streams, and ditches. Thus, it is termed an artificial ecosystem. The main features sought in the read out of the satellite photographs were the dynamic laws of change in the corridor's oasis ecosystem stemming from changes in the ecology of the southern Qilian Mountain region. Read out of video pictures made from remote sensing photographs* showed no striking changes in either the horizontal or vertical direction in this ecosystem. Apart from man-made oases, the landscape was a desert.

(1) Changes in moisture conditions. The role of humans in changed moisture conditions has been rather marked. Since founding of the People's Republic, with the building of reservoirs, the lining of irrigation ditches with stones or bricks (over a 4,218 kilometer area), improvements in irrigation projects, and upgrading of irrigation techniques, the amount of irrigation water lost through seepage has been reduced. Data provided by the Gansu Provincial Geology Bureau Research Team showed a 42 percent reduction in total seepage during the period 1974-1976 as compared with the period 1957-1960. This included a 48 percent reduction in seepage from irrigation ditches, and a 28 percent reduction is seepage from rivers. In view of this evolutionary trend, use of four wave band satellite photographs in conjunction with read outs of remote sensing video pictures produced quite good results. Areas in which tremendous decreases in the amount of water seepage have taken place showed up as increasingly light colors as we went from fourth wave band to seventh wave band pictures. This was because of the reflected spectrum of ground cover, which was inherently related to water under the surface layer of soil.

In addition, observation of fourth wave band satellite photographs showed serious silting of numerous reservoirs such as the Huangyang, Jinta, Xiying, Caojiahu, and Dajingxia reservoirs. On fourth wave band satellite photographs, silted areas showed up in light tones. This showed the eroded area of the southern Qilian Mountains to be fairly extensive.
In recent years, wells have been sunk on a large scale in the

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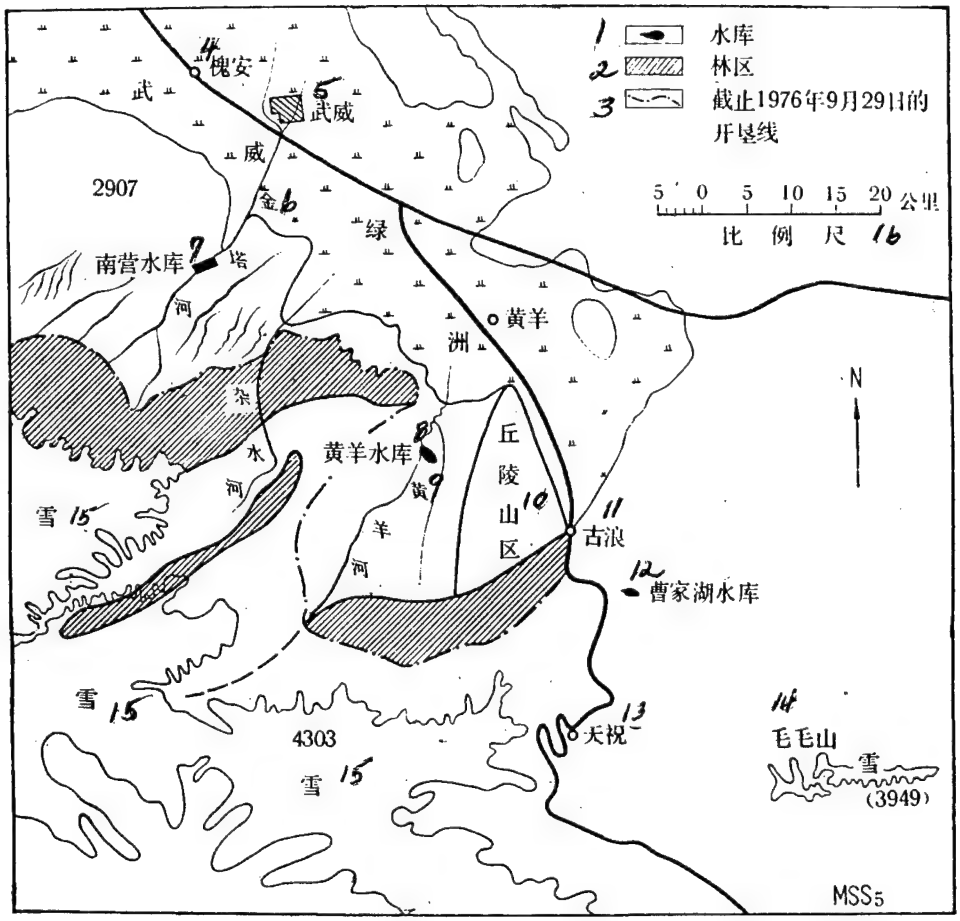
* This means use of television recorder methods to combine into single photographs remote sensing pictures and ground observations. We made two sets of video pictures of Wuwei Prefecture, one in 1980 and one in 1981.

destroyed much ground cover. In the Haqi region of the Qilian Mountains alone, more than 170 mines have been opened and bushes and trees destroyed over several hundred mu. This has also led to erosion, an increase of silting in streams, and has been the basic reason why river beds and reservoirs becoming choked with silt.

Figure 6. Sketch Map Prepared From Readout of Satellite Photograph of Clearing of Land For Farming in Forested Area of Qilian Mountain Region of Wuwei Prefecture



Key:

1. Reservoir
2. Forested Area
3. Reclamation Line as of 29 September 1976
4. Huaian
5. Wuwei
6. Jinta River
7. Nanying Reservoir
8. Huangyang Reservoir
9. Huangyang River
10. Hills and mountains
11. Gulang
12. Caojiahu Reservoir
13. Tianzhu
14. Maomao Mountain
15. Snow
16. Scale in kilometers

Their peak and trough lines stand out clearly and their planes are fairly regular.

(2) Soil alkalinization. Since sources of water have declined sharply in the northern desert region, too much pumping of ground water has been done (in Minqin County pump wells number 8,500). Highly mineralized ground water (4 grams per liter) is used to irrigate the fields, and this has led to serious soil alkalinization over most the area. We used remote sensing video recorded pictures in combination with on-site pictures recorded during 1980 and 1981, which revealed that in Congzhen Commune in Minqin County alone, alkaline and saline land amounts to 7 percent of all cultivated land.

(3) Development of water sources. Change in the northern desert ecology means mostly solving the problem of sources of water. We used multi-wave band satellite photographs and found an area with abundant water in the Takla Makan Desert (Figure 8) In figure 8, an old river bed crosses at the foot of Laifu Mountain. By using the remoting sensing video recorder method, freshwater could be seen at a depth of more than 5 meters. On-site verification made during July 1981 showed good quality water at a depth of 3.75 meters.

Figure 7. Sketch Map Showing Distance Between Ninqin Oasis and the Desert

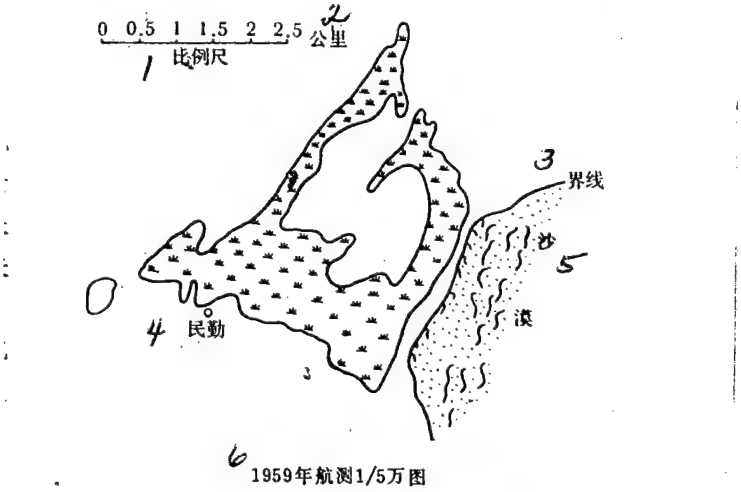
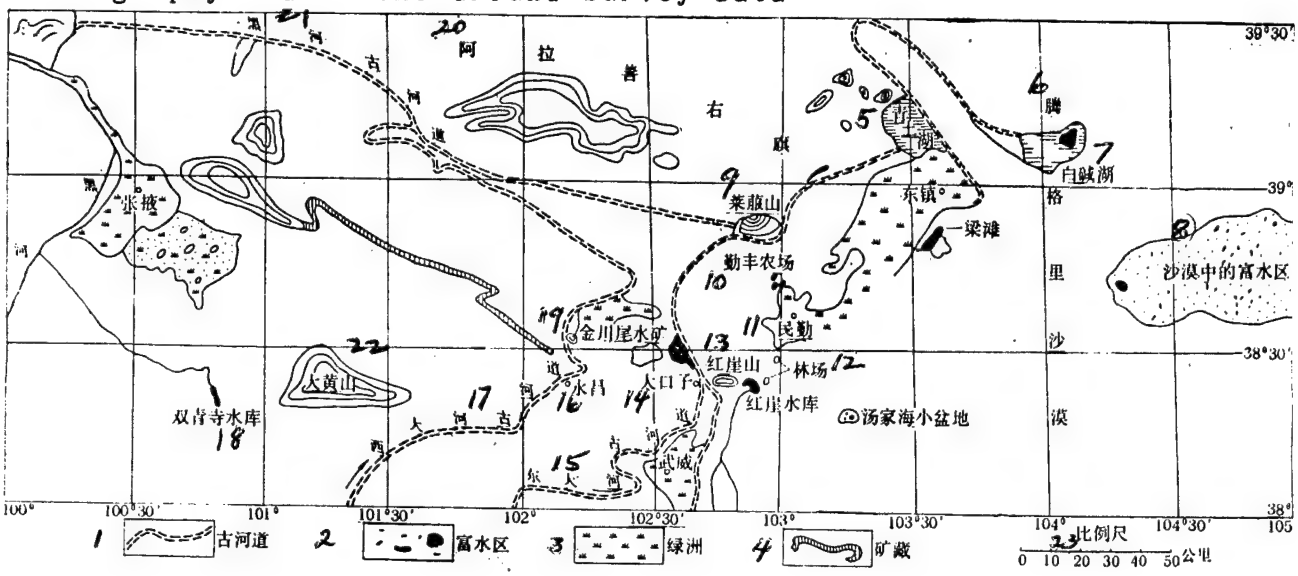


图7 民勤绿洲与沙漠的间距示意图

Key:

1. Scale
2. Kilometers
3. Boundary line
4. Minqin
5. Desert
6. 1959 Aerial Survey, 1:50,000

Figure 8. Sketch Map of Minqin Area Incorporating Both Satellite Photography and On-the-Ground Survey Data



Key:

1. Old river bed
2. Abundant water area
3. Oasis
4. Mineral deposits
5. Qingtu Lake
6. Takla Makan Desert
7. Baijian Lake
8. Abundant water in desert
9. Laifu Mountain
10. Qinfeng Farm
11. Minqin
12. Forest farm
13. Hongya Mountain
14. Dakouzi
15. Dongda River, old bed
16. Yongchang
17. Xida River, old bed
18. Shuanqingsi Reservoir
19. Jinchuanwei water deposit
20. Alashan Left Banner
21. Hei River, old bed
22. Dahuang Mountain
23. Scale in kilometers

(2) Supplementary Field Verification of Readouts of Remote Sensing Pictures of the Wuwei Prefecture Agricultural Ecology

Repeated on-site verification has shown readouts from remote sensing photographs to be highly accurate. In the southern Qilian mountain forest regions, it has been mostly destruction of forests and grasslands, the nibbling away at scrub growth, the clearing of land for farming, and the burning of mountains that has impaired water resources and led to soil erosion. Survey shows the population of the forested area has reached 230,000, which is more than three times what it had been in the 1950's. During the past 10 years, more than 800,000 mu has been cleared for agriculture alone.

In addition, the burning of mountains is everywhere a fairly common practice that destroys large quantities of sod. Huangchuan Commune has estimated that in another 5 or 10 years, all of it will be burned away. Measurements show a total annual accumulation of more than 100,000 cubic meters of silt in Huangyang, Jinta, and Xiying reservoirs. In the 10 years between 1969 and 1979, 4.76 million cubic meters of silt have accumulated, and as of 12 June 1981, the reservoirs held only 1.3 million cubic meters of water.

As a result of the foregoing, precipitation in the upper reaches has increased, while the runoff out of the mountains has decreased in an abnormal situation. Records of the Daheba Precipitation Measuring Station and the Chajianmen Precipitation Measuring Station in the upper reaches of the Xida River show a 54.5 percent and a 5.5 percent increase respectively in amount of precipitation in the 1970's as compared with the 1950's, but a 19 percent decline in the amount of runoff out of the mountains. During the 1960's, changes in mountain streams were regular, a high point occurring once every 2 years to be followed by a low point. During the 1970's there was no rhyme or reason to the changes.

In view of the sharp decline in the amount of water, numerous wells have been sunk and ill-advised expansion of cultivated area undertaken in the middle and lower reaches. This has brought on a drop in the water table, an increase in saline and alkaline land, and the spoiling of water quality.

A survey shows an average 13 pump wells per square kilometer in Pingluo Brigade, Xinxian Commune, in Wuwei County, and in the Changning irrigation area, the ground water table is falling by between 0.5 and 2 meters annually.

In 1975, Chengxi Brigade, Daba Commune in Minqin County cleared land for farming at Miechaiwan. As a result the shifting sand advanced eastward, not only burying in sand the 100 mu of farmland that had been cleared that year, but also causing sand damage to more than 200 mu of old farmland. Grain output fell by more than 40,000 jin from the previous year.

2. Regression of Loess Highlands Natural Grasslands

Satellite photographs show the operation of definite laws in the distribution of natural grasslands in the loess highlands. Usually distribution is along geological lines. Such is the case with the fault line in the foothills of the Juewu Mountains, the fault line in the foothills of Mayu Mountain and Xinglong Mountain, along the fault line that runs to the north of Lanzhou from

Qingbai Mountain to Yanchangbao, and from Baita Mountain to Shajingyi (a distance of more than 20 kilometers as measured on a satellite picture). The grasslands parallel these fault lines and are about the same distance on each side of them, and may be generally divided into several different grasslands. On-site surveys and video recordings from 1980 discovered that ill-advised reclamation of land for agriculture has been serious in this area in recent years. The fine grass range area has shrunk, and serious regression is taking place on what remains. As a result, soil erosion has intensified. This hurts quality of livestock products while at the same time impairing grain output.

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AGRICULTURAL, STEPPE ECOLOGIES COMPARED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983, pp 33-36

[Article by Cai Weiqi [5591 5588 4362], Institute of Soil Science, Chinese Academy of Sciences, Nanjing]: "On Reclamation of the Steppe"]

[Text] Because of rapid population growth and constantly increasing need for food, during the past 20 years China has restricted the growing of cash crops in sole pursuit of increased grain output. As a result, the proportion of total cultivated land devoted to the growing of grain has increased. At the same time, many ways have been used to increase cultivated land area. They have included reclamation of wastelands and reclaiming land from the sea and from lakes, etc. As a result, not only has the internal structure of agriculture been damaged, but a proportional imbalance has occured between farming and forestry, animal husbandry, and the fishing industry that has affected the entire ecological equilibrium. Because objective laws have been contravened, nature may make retribution. This prospect has aroused serious attention everywhere, and some erroneous methods are in the process of being overcome and corrected.

So called wasteland is actually not wasteland at all. An overwhelming majority of it is natural grassland used for animal husbandry. To tell the truth, reclamation of wasteland means reclamation of grasslands for the most part. Internationally, the environment has deteriorated in both the United States and the USSR as a result of improper reclamation of grasslands. Windblown sand brought calamity, and losses were huge. Inside China, development of agriculture in the upper reaches of the Yellow River led to soil erosion, to frequent flooding of the Yellow River, and to frequent disasters. Reclamation and cultivation of the middle reaches of the Xiliao River caused the present day large areas of moving sand dunes and sand mounds on both sides of the river. These are no isolated examples. These very painful lessons should teach us something, and the same old disastrous road should not be followed again. However, recently

there has been an expansion of reclamation and cultivation of the semi-moist, semi-arid marshy grasslands and steppes of northeastern China and Nei Monggol. In the development of farming, the lessons of predecessors' experience have not been conscientiously learned. In some places the only criterion has been expansion of the area reclaimed for cultivation, and some grasslands not suitable for reclamation have been ill-advisedly reclaimed. In some places, an effort to recoup investment in reclamation has resulted in failure to bring along concomitant projects that should be developed for the building of farmland. Though reclamation has been done on the basis of the land's characteristics, where extensive farming practices have been used, the old steppe ecological system has been destroyed, and a new farmland ecological system has not been estalished. How to restore the original step ecosystem, and how to establish a rational farmland ecosystem are problems meriting study and exploration.

A steppe ecosystem and an agro-ecosystem have points in common and differences. Their points in common include being types of land ecosystems; they are a unity formed from organisms and an environment. An energy flow and the circulation of matter goes on between the organisms and the environment to form primary production, thereby giving expression to the system's structural function. A look at their differences show that the grassland ecosystem may be regarded fundamentally as a natural ecosystem, while the agro-ecosystem is an artificial ecosystem produced by human activities.

Energy flow and the cycling of matter in a grassland ecosystem goes in under fundamentally natural conditions, and on a small scale. Inputs into the system are slight, and outputs from the system are correspondingly slight. The system's productivity is not high. Generally speaking, this system goes on with very little human interference. It relies on the system's own photosynthesis, metabolism, and regulatory ability to maintain its ecological balance. It should be pointed out that in actual practice, an overwhelming majority of China's natural grassland ecosystem is used for pasturage. Large areas are used for light pasturing. They are used properly, and their use does not exceed the systems's own limits for regeneration. Fine renewal of the system can be assured, and they can continue permanently to maintain their productivity. However, in some instances, possibly because of too many livestock per unit of area, the grasslands have more than they can support, and when the grassland ecosystem's own regulatory capabilities are not able to maintain ecological balance, the grasslands must inevitably degenerate. This is manifested in poor grass quality, a decline in grass output, or even the desertification of the grasslands. When this happens, it is very difficult to revive the former state of the grass-

lands. Experiments conducted in Colorado in the United States show that when grasslands are used for pasturing livestock, the quantity eaten by livestock cannot be more than 40 to 50 percent of output at maximum. If it is, the ecological balance will be destroyed. Thus one can see that when the grassland ecology is relied on to maintain itself, with no artifical inputs of energy or matter, not only is productivity low, but when sufficient materials and manpower are lacking (manpower being another form of energy), its use for herding is still fairly rational and, in addition, its economic benefits are not low.

An agro-ecosystem is an artificial ecosystem affected by man's will. Since the scale of its energy flow and cycling of matter can be controlled and increased by man, extra energy and matter must be inputted into the system first of all. Only in this way is it possible to achieve the goal of increased energy flow and increased cycling of matter. In addition, only in this way can outputs in the form of productivity possibly increase correspondingly. This portion of goods that is produced by the system are ultimately virtually all removed from the system and taken away. They play no part in the next cycle of energy flow and cycling of matter. Therefore, maintenance of equilibrium in the agro-ecosystem cannot be done through reliance on the system's own recuperative powers. Large amounts of extra energy and matter must be added. Cultivation of the soil, fertilizing, and irrigation are all methods by which energy and matter are increased, and they are indispensable. Only when energy and matter inputs are increased can the energy flow and the cycling of matter increase, and only then is it possible to derive the maximum output of products from the system. Furthermore, as the system carries on, it is necessary to regulate it constantly. Unless this is done, a fine agro-ecosystem cannot be built, and the fine agro-ecosystem that has been built cannot be maintained. Take Taipusi Banner, Zhenglan Banner, and Dulun in southern Xi League in Nei Monggol, for example. This league is in an area where the steppe and the marshy grassland steppe meet. Objective elements for the building of an agro-ecosystem here were not as favorable as in the Songnen Plain in northeastern China; nevertheless, in view of agricultural production conditions here, when the masses went into farming, they went from little fertilization to fertilization with 25-30 cartloads per mu of mud fertilizer, and 20-25 jin per mu of nitrogenous fertilizer. During the 1970's, they began to use even more nitrogenous fertilizer. Their farming methods also changed. They went from alternate cultivation and fallow to rotational cropping of grain and grass. Most places built ponds and blocked off streams for use as water conservancy projects to change drylands to watered lands. Crop yields per unit of area climbed steadily. Wheat yields went from 120-150 jin per mu to 250-300 jin per mu. We have collected soil samples

from several farms that have been reclaimed and cultivated for 80 to 100 years, results from the analysis of which are shown in Table 1.

Table 1. Chemical Analysis of Farmland Soil

采样地点 (1)	利用方式 (11)	耕垦年限 (18)	土层深度(厘米) (22)	有机质 (23)	全氮 (24)	C/N	速效性磷 (P_2O_5) (25) 克/100克	速效性钾 (K_2O) (26) 克/100克	pH	$CaCO_3$ (%)	质地 (27)
2) 多伦县大	12) 荞麦地	19) 约80年	0—10	2.32	0.140	9.61			8.2		28) 沙壤土
3) 北沟西山			10—42	2.15	0.119	10.48			7.7		28) 沙壤土
4) 根			42—59	2.09					7.7		29) 轻壤土
			59—86	2.08					8.0		
5) 太仆寺旗	13) 小麦地	19) 约80年	0—12				1.50	22.7	8.7	0.46	29) 轻壤土
6) 西北刘总			12—31	2.36	0.167	8.20	0.50	11.6	8.9	1.53	29) 轻壤土
7) 广营子			31—50	1.51	0.097	9.03	0.80	8.6	9.1	16.53	28) 沙壤土
			50—72						9.2	6.89	28) 沙壤土
5) 太仆寺旗	14) 麦茬	20) 近100年	0—12	4.01	0.243	9.57	1.85	37.0	8.4	4.96	30) 壤 土
8) 西马坊	15) 后的秋		12—34	3.33	0.225	8.58	1.00	14.8	8.4	5.71	30) 壤 土
	16) 翻地		34—57	2.62	0.168	9.05	0.60	13.2	8.5	5.12	30) 壤 土
			57—80						8.7	15.96	30) 壤 土
5) 太仆寺旗	17) 秋翻地	19) 约80年	0—12	3.23	0.185	10.12	1.30	16.9			29) 轻壤土
9) 头号			12—24	2.94	0.172	9.91	0.80	10.3			30) 壤 土
			24—40								29) 轻壤土
			40—54								29) 轻壤土
5) 太仆寺旗	12) 荞麦地	21) 80余年	0—14	2.72	0.145	10.88	1.20	22.0			29) 轻壤土
10) 西山			14—20	1.58	0.094	9.75	0.41	7.0			30) 壤 土
			20—40								29) 轻壤土

Key:

1. Place from which sample taken.
2. Duolunxianda
3. Beigouxishan
4. Gen
5. Taipusi Banner
6. Xiubeiliuzong
7. Guangyingzi
8. Ximafang
9. Touhao
10. Xishan
11. Way soil was used
12. Naked oats soil
13. Wheat soil
14. Soil following a wheat crop
15. Late fall crop
16. Plowed soil
17. Soil plowed in fall
18. Number of years in cultivation
19. About 80 years
20. Nearly 100 years
21. More than 80 years
22. Soil layer depth
23. Organic content
24. Total nitrogen
25. Quick acting phosphate (mg/100 g)
26. Quick acting potash (mg/100 g)
27. Kind of soil
28. Sandy loam
29. Light loam
30. Loam

Table 1 shows that despite 80 to 100 years of cultivation, because matter and energy were added, soil nutrients have not noticeably declined. Organic material in the surface layer to a depth of 30 centimeters averaged 2.75 percent, and total nitrogen content was 0.166 percent as compared with an average 3.14 percent organic content and a 0.187 percent full nitrogen content for unfarmed dark chestnut soil, lower by about 15 and 12 percent respectively. In the cultivated layer to a depth of from 0-10 (12) centimeters, as a result of fertilization, both organic and complete nitrogen content were maintained at original levels, and the quick acting phosphate and potash content remained at that of unfarmed soil. No noticeable change occured in soil quality either. One can conclude that experience in converting a steppe ecosystem to an agro-ecosystem in this area was succesful. In recent years, with human regulation, these agro-ecosystems have moved in the direction of stability and high effectiveness.

In summarizing reasons for failure in the reclamation of grasslands, two things should not be omitted. One is lack of understanding of the individual requirements of a steppe ecosystem and of an agro-ecosystem. Places where conditions did not favor agro-ecosystems mistakenly transformed the steppe ecosystem into an agro-ecosystem. Examples are classic steppe areas or sandy mother material steppes or marshy grassland steppe areas in semi-arid climates without irrigation resources. As a result, the agro-ecosystems that have been established have been both low and inconsistent in productivity. Several years subsequently, when windblown sand developed, desertification occurred quickly. When matters turned out different than expectations, abandonment of cultivation was the only course open. Once farming has been abandoned, a change occurs in the make-up of the kinds of plants, and it is difficult to restore the kind of steppe ecosystem that existed before reclamation. Worse yet, the fine steppe ecosystem in neighboring areas that have not been reclaimed may be damaged. Such was the case at a place 2 kilometers from Laoer Brigade in Dongfeng Village on the Xilinguole Plain where formerly Aneurolepidium Chinense (Trin.) Kitagawa and mixed grasses grew on the steppe. Following reclamation, farming was done for only 3 to 5 years and then abandoned. For the first and second year following abandonment, only salsola, which is of little value for grazing livestock, grew. Only after 3 years did an increase occur in plants of the artemesia family. Quality of the grasslands was very low. Between 5 and 7 years later, the original plants gradually began to increase, but the original cover could not be restored. At the time samples were taken, farming had been abandoned at the site for almost 10 years, but clumps of salsola and miscellaneous grass covers remained. Moreover, the cover rate was scant, and grass output was not up to original levels. See Table 2 for a physical analysis of each soil layer.

Table 2. Physical Analysis of Soil About 10 Years After Abandonment of Reclamation Farming 2 Kilometers East of Laoer Brigade in Dongfeng Village

1)采样深度(厘米)	有机质(%)	全氮(%)	C/N	pH 4)(水提)	$CaCO_3$(%)	5) 各级颗粒含量(毫米、%) 1—0.25	0.25—0.05	0.05—0.01	0.01—0.005	0.005—0.001	<0.001	<0.01毫米的总量(%) 6)	质地 7)
5—15	1.43	0.119	6.97	8.5	0.28	19.5	59.3	9.5	2.5	2.5	6.7	11.7	粗沙土 8)
25—35	1.12	0.078	8.33	9.2	4.92	12.1	59.6	10.9	2.2	4.2	10.4	16.8	〃
55—65	0.90			9.1	7.72	6.4	41.0	22.3	5.2	6.3	18.9	30.4	粉壤土 9)
100—110	0.74			8.9	6.29	1.9	31.4	30.4	6.1	6.9	23.4	36.4	壤粘土 10)
155—165	0.48			9.4	6.60	8.6	35.9	22.7	4.9	6.8	21.0	32.7	粉粘土 9)

Key:

1. Depth at which samples taken (centimeters)
2. Organic Matter
3. Complete nitrogen
4. pH (aqueous extract)
5. Content of each grade of grains (millimeters, %)
6. < 0.01 millimeters total volume (%)
7. Kind of soil
8. Coarse sandy soil
9. Powdered soil
10. Clayey soil

Table 2 shows that following reclamation fine particles in the surface layer of the soil were blown away. As compared with lower layers, < 0.01 millimeter fine particles declined by 5 to 20 percent; coarse grains of from 0.25 - 1 millimeter increased 7 to 13 percent; 0.05 - 0.25 millimeter grains increased 20 percent; and as a result of fine particles on the surface having been blown away, grains above 35 millimeters had become a coarse sandy soil. Grains of less than 100 millimeters remained as powdered clayey soil. Soil fertility also declined. Organic matter in the surface layer to a depth of 30 centimeters fell. As compared with nearby steppe soil with a 3.14 percent organic content, it had decreased by 60 percent. Complete nitrogen content was only about 0.1 percent, less than one half that of the steppe soil. The steppe ecosystem had been destroyed.

Yet another circumstance was that because of lack of understanding of the different characteristics of energy circulation and cycling of matter in these two ecosystems, methods suited to the steppe ecosystem were used in handling the agro-ecosystem. Even places with fine agro-ecosystem conditions were not managed as farmlands required. Only high soil fertility, good moisture conditions and such advantageous factors were watched, and the

system was relied on to regulate and replenish itself. Everything was taken and nothing given. People were satisfied with the high yields of the first several years, and changes in the functioning and structure of the system did not arouse their sufficient concern. Under such plundering style management, the balance tottered; yields gradually declined, and the system gradually deteriorated. An example is the Songnen Plain in northeastern China, which is located in a marshy grassland steppe area. Between 10 and 20 years after reclamation, the surface began to erode and the soil began to wash away. Nutrients declined, and yields fell from the 300-400 jin per mu of period immediately following reclamation to 100-200 jin per mu, less than half what they had been at the outset. One can predict that once a system has been damaged in many ways and it cannot continue to maintain its dynamic balance, efforts to restore it and make it into a fine agro-ecosystem will be very difficult indeed. Therefore, even in places where temperatures are right, rainfall copious, and the soil fertile, unless soil is handled in accordance with agro-ecosystem energy flow and matter flow characteristics after it has been developed for cultivation, with necessary extra energy and matter being added, its productivity will gradually decline. Even more seriously, a hidden chain of bad consequences may ensue from loss of equilibrium until the ecosystem is completely destroyed.

This shows that conceptions of ecosystems must guide the reclamation of the steppes. In steppe areas where conditions do not exist for the establishment of an agro-ecosystem, generally speaking no further reclamation should be done. In such places that have already been reclaimed for agriculture, natural laws should be followed and the land allowed to revert to pasture. It would be well to take action to compact the surface of the soil, to sow seeds, and to close the area off to help the area removed from cultivation restore its vegetation cover quickly, and return to its original steppe ecosystem. Though, objectively, marshy grassland steppe areas exist with natural conditions for the building of agro-ecosystems, it is necessary also to see whether all the associated projects that an agro-ecosystem needs are in working order, whether the energy and matter needed for replenishment is adequate and, only once these conditions have been met, to organize the building of an agro-ecosystem. Once it has been built, it has to be managed earnestly and conscientiously. Use of methods applicable to a steppe ecosystem to run farmlands will inevitably fail. That is becaue the former is in the realm of a natural ecosystem with a structure and function that is fairly simple. Its energy flow and material flow are fairly small. The system's production is fairly low, and fairly little is taken out of the system. Its own regenerative abilities can be relied on substantially for the maintenance of equilibrium. The

latter, however, is an artificial ecosystem. Its structure and functions are complex, and a fairly large number of factors influence it. Man's activities can produce positive affects, or they may bring bad consequences. Reliance on the systems own regeneratifve abilities will not make up for the material and energy that has been taken out of the system. Therefore, only when objective conditions permit and when subjective desires do not contravene objective laws is it possible with effort to transform a steppe eocystem into an agro-ecosystem. Otherwise, continued maintanence of a step ecosystem with natural pasturing of livestock is both more rational and more satisfactory both for protection of the ecological environment and in terms of economic benefits outputted by the system versus inputs into the system.

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AN AGRO-ECOSYSTEM IN MICROCOSM DETAILED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983 pp 1-6

[Article by Agro-ecological Cooperative Group of the Mid-Sichuan Basin, Sichuan Province: "An Embryonic Form of Agro-ecosystem Equilibrium in the Mid-Sichuan Basin -- Linshan People's Commune, Yanting County"] *

[Text] Drought and waterlogging disasters have occurred repeatedly in Sichuan Province in recent years. Destruction of the ecological balance has intensified the seriousness of disasters caused by the circulation of air currents in the atmosphere. Can man's subjective efforts bring about equilibrium in the agro-ecosystem? How can general methods be adapted to specific situations to bring about an equilibrium in the agro-ecosystem? These questions have been discussed previously,[1] so now let us make further exposition of them by using the experiences of Linshan Commune in Yanting County.

The building of an embryonic form of equilibrium in the agricultural ecology of Linshan Commune was part and parcel of an understanding of the agro-ecosystem gained over a period of many years.

An agro-ecosystem must be looked at in terms of the entire agricultural production system being a unified system of motion in which the environment's energy is ceaselessly transformed and matter is ceaselessly cycled.

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An agro-ecosystem functions to transform the latent productivity of environmental resources into actual output, manifesting their productivity through diverse biological colonies as well as the interaction of biological colonies with environmental resources. The higher an agro-ecosystem's efficiency in transforming matter and energy, the higher the systems's productivity. This article focuses discussion on the relationship between farmland structure and environmental conditions.

A region's building of a rational, balanced agricultural ecological structure of high productivity may be divided into two steps. The first is full rational use of the local area's natural agricultural resources, taking in hand transformation of those environmental conditions that can be regulated and that affect plant growth as principal local contradictions require, and assure, insofar as possible, control of a balanced supply of such things as water and fertilizer, thereby building a continuously flowing, powerful matter and energy transformation system. The second step is readjustment of the internal structure of biological colonies and their relationship to the envir onment, thereby attaining optimum efficiency in the transformation of matter and energy for low consumption and high productivity. The two steps are interrelated and intertwined.

Characteristics of the Transformation of Farmland Ecological Balance

Linshan Commune was able to reverse its vicious cycle through 8 to 10 years of all-around control efforts, a series of changes taking favorable to ecological balance occuring in the landscape.

1. Changes in the Forest Landscape. Grasslands were afforested with a mixture of alder and cypress, which after 3 to 5 years closed to 0.6 - 0.9, and within the woods, the micro-climate changed. Measures taken during the hot dry season of 1978 when the forest cover rate was between 35 and 40 percent showed a relative humidity higher than 60 percent likely to occur in 72 percent of the farmland area 200 meters distant, while in areas with a 15 to 20 percent cover rate the probability was only 50 percent. In addition, the composition of the grass cover on the forest floor also underwent great changes as shown in Table 1.

[See following page for Table 1]

Table 1. Comparison of Mixed Alder and Cyprus Covered Slopes With Barren Slopes (August 1980)

柏梓公社 9—1队 1) 茅草坡			林山公社 4—4队 2) 桤柏混交林			林山公社 3—1队 3) 桤柏混交林		
4) 无			5) 柏木 9 5.018方/亩	6) 桤木 8 2.47方/亩		7) 柏木 10 5.47方/亩	8) 桤木 4 3.49方/亩	
9) 种类	10) 盖度%	11) 高度(厘米)	9) 种类	10) 盖度	11) 高度(厘米)	9) 种类	10) 盖度	11) 高度(厘米)
12) 扭黄茅	85	100	17) 蕨类	70%	20	14) 白茅	22) 多	70
13) 枹李	0.5	17	18) 地瓜藤	50%	10	21) 莎草	23) 少量	
14) 白茅	0.3	49	19) 黄荆	10%	80	12) 扭黄茅	23) 少量	
15) 芨芨草	0.3	50	20) 悬钩子	5%				
16) 雀稗	0.8	50						

Key:

1. 9-1 Brigade, Bozi Commune, cogongrass slopes
2. 4-4 Brigade, Linshan Commune, mixed alder and cyprus forest
3. 3-1 Brigade, Linshan Commune, mixed alder and cyprus forest
4. None
5. Cyprus timber, 5.018 cubic meters per mu
6. Alder timber, 2.47 cubic meters per mu
7. Cyprus timber, 5.47 cubic meters per mu
8. Alder timber, 3.49 cubic meters per mu
9. Kind
10. Percent covered
11. Height (centimeters)
12. Niuhuang grass [2100 7806 5403]
13. Buckthorn [Rhamnus japonicus]
14. Imperata arundinacea
15. Chinese alpine rush [Eulaliopsis binata]
16. Paspalum thunbergii
17. Pteridophytes
18. Sweet potato vines
19. Five-leaved chaste tree [Viter nigundo]
20. Blackberries
21. Nutgrass flatsedge [Cyperus rotundus]
22. Much
23. Small amount

Table 1 shows that after barren slopes were afforested, grass family plants on the forest floor gradually were replaced by moisture loving pteridophytes and members of the rose family. Grass family plants such as imperata arundinacea and Chinese alpine rush on grassy slopes bloomed and fruited during July and

August, while those on the forest floor did not bloom and fruit until November. Their leaves became tender for an increase in the edible portion, and quality of the grass was improved. Linshan Commune's total grass output was similar to that from grassy mountains in the county.

As the forest landscape underwent a transformation, animal life within the forest began to change as well. (See Table 2). Mynas, tits, and ducks, and wild rabbits, yellow weasels, and badgers increased greatly. The formation of new links in the food chain became inevitable within the area.

Table 2. Table Showing Main Birds and Animals Surveyed in Winter in Linshan and Chengguan Communes

1) 林山				2) 城关		
3) 鸟类	4) 种数*	5) 优势种	6) 每小时** 遇见机率(只)	4) 种数	5) 优势种	6) 每小时 遇见机率(只)
	25	8) 红头长尾山雀	18.2	12	10) 黄臀鹎	28.2
	7) (雉、鹌鹑、伯劳、翠鸟、画眉、鸠鸽、鹌鹑、鸢、掠鸟、山雀、鸭、隼、鹞等)	大山雀	13.5	9) (雉鸡、伯劳、翠鸟、鸦、掠鸟、鹞、山雀、鸠鸽、画鹛等)	麻雀	28.8
		白头鹎	61.2			
	11) 经济鸟类		12) 多度***	11) 经济鸟类		12) 多度
		13) 八哥	+ + + +		14) 八哥	+ +
		环颈雉	+ +		环颈雉	+
		山斑鸠、珠颈斑鸠、竹鸡、赤麻鸭、普通鸳	+		山斑鸠、珠颈斑鸠	+
兽类 15)	16) 5 (草兔、黄鼬、猪子、狸子、狐)	草兔 (17)	2—3	2 (草兔、黄鼬) (18)	草兔 17	0.2

* denotes family and sub-family.

** Results of 16 hours of observation on five separate occasions at representative brigades in each commune in the winter of 1981

*** "+ + + +" means most; "+ +" means fairly numerous; and "+" means few.

Key:

1. Linshan
2. Chengguan
3. Birds
4. Kinds*
5. Dominant variety
6. Number likely to be seen each hour**
7. (Pheasants, wagtails, shrikes, kingfishers, thrushes,

turtledoves, mynas, ducks, lue [2230] birds, bulbuls, tits, turtledoves, and thrushes.

8. Red head long, Weishan sparrow, great mountain sparrow, white headed bulbul
9. (Zhiling [7164 7701], shrikes, kingfishers, crows, lue birds, bulbuls, tits, turtledoves, and thrushes)
10. Huangbeibi [7806 5242 771D] ,sparrows
11. Birds of economic value
12. Extent***
13. Mynas, ring-necked pheasants, mountain turtledoves, pearl necked turtledoves, partridges, chima [6375 7802] ducks, and common buzzards
14. Mynas, ring-necked pheasants, mountain turtledoves, and pearl necked turtledoves
15. Animals
16. European rabbits [Lepus europaeus], yellow weasals, badgers, panthers
17. European rabbits
18. (European rabbits, weasals)

2. Changes in the Soil Landscape. Remaking of the fields and the land transformed the "form" of the soil's surface, and application of large quantities of lader leaves changed the "substance" of the soil. The commune produced 3.37 million kilograms of green alder leaves annually (a low value assigned).[2].Survey of 671 mu of cultivated land in four representative brigades showed 100,600 jin of fresh alder leaves used in the spring of 1980, and another 62,000 jin of alder leaves used in winter, 1.32 million kilograms of alder leaves being used for the commune as a whole. This was an average of 1,000 - 1,500 jin of dry alder leaves per mu of drylands, and 1,000 - 1,500 jin (fresh weight) per mu of wetlands. This was the equivalent of 120 - 180 jin per mu of standard nitrogenous fertilizer for drylands, or 40 - 60 jin per mu for wetlands. In addition 1,000 - 2,000 jin of mulch composed of elder leaves, sod, and stalks and stems of plants, and 5,000 - 10,000 jin of nightsoil was spread. A 1980 soil survey of three representative communes in the south, north, and middle (Linshan) parts of the county discovered through analysis of cross sections of various kinds of fields that the soil content of carbon, nitrogen, and other effective nutrients in Linshan Commune was higher than in neighboring Baizi Commune, where natural conditions had not been treated. Sampling of for farmed specimens of surface soil derived similar results. See Table 3.

[See following page for Table 3]

Table 3. Statistics on Average Content of Major Nutrients in Cultivated Layer of soil at Linshan and Bozi Communes*

1)土 壤	2)取样公社	3)有机质%	4)全 氮%	5)水解氮(ppm)	6)有效钾(ppm)	7)统计样品数
8)水稻土（泥田）	10)林 山	2.30	0.138	108.5	110.7	5
	11)柏 梓	1.17	0.091	71.0	106.9	3
9)旱地土（羊肝土）	10)林 山	0.77	0.053	62.0	96.2	6
	11)柏 梓	0.50	0.064	59.4	84.1	3

*Coefficient of variation in statistics less than 30 percent

Key:

1. Soil
2. Commune at which sample taken
3. Organic material (%)
4. Total nitrogen (%)
5. Hydrolitic nitrogen (ppm)
6. Effective potash (ppm)
7. Number of samples
8. Paddy rice soil (muddy fields)
9. Drylands (yanggan [5017 5139] soil
10. Linshan
11. Baizi

Table 3 shows an organic content for paddy field soil in Linshan Commune that is about 1.13 percent higher than for Baizi Commune. For drylands, it is 0.27 percent higher. The question remains as to whether the quantity of organic fertilizer used at Linshan Commune meets required standards. Control experiments we conducted at Zhenjin Commune in Jianyang County using dried straw and yellow flowered alfalfa applied to wetlands and drylands (300 jin, 500 jin, and 800 jin) brought us to the conclusion that a substantial increase had occurred in organic matter in the soil of Linshan Commune. Each season 800 - 1,000 jin (dry weight) per mu of organic fertilizer was applied, and wetland yields amounted to 800 - 1,000 jin per mu while dryland yields amounted to 1,000-1,300 jin per mu. A substantial balance was struck between supply and demand for organic fertilizer.

3. Balance Between Supply and Demand of Water for Agriculture. In addition to afforestation for retention of water, Linshan Commune devoted extremely serious attention to the impounding of runoff, regulated the amount of water available in individual places and from year to year, and used the potential provided by surface water and ground water. Over the short term, a virtual balance will exist between the planned sources of water and the amount used, the supply and the demand. See Table 4.

Table 4. Comparison of Linshan Commune's Short-term Plans For Water and Use of Water

1)年型 P(%)	2)工程供水 3)existing 地面水(万方)	地下水(万方)	4)planned (万方)	合计(万方)	8)灌溉用水量(万方)	9)来水—用水 10)surplus(万方)	11)shortage(万方)
20	71.91	27.97	—	99.88	47.22	52.66	—
50	55.50	25.60	—	81.10	55.51	25.59	—
80	32.20	23.22	15	70.42	71.45	—	1.03

Key:

1. Annual rate (%)
2. Projects for supply of water
3. Existing (10,000 cubic meters)
4. Planned
5. Surface water (10,000 cubic meters)
6. Ground water (10,000 cubic meters)
7. Total (10,000 cubic meters)
8. Quantity used for irrigation (10,000 cubic meters)
9. Supply of water - Use of water
10. Surplus (10,000 cubic meters)
11. Shortage (10,000 cubic meters)

4. Upgrading of Systems' Resistance Abilities to Assure a Normal Cycling of Matter and Energy Transformation. In this area, resistance abilities means mostly resistance to withstand drought and floods. Because the region is able to impound and regulate water to a certain extent, it has been able to put to use a combination of surface water, ground water, water in the soil, and water in forests. It was able to withstand the test of 3 consecutive years of drought from 1977 to 1979, and in 1977 grain yields reached an all-time high. During an exceptionally great flood in 1981, the area's ability to withstand floods was demonstrated even more strikingly. From 12 - 14 July 1981, torrential rains centering on Yanting County brought a rainfall to Linshan Commune recorded at 306 millimeters. Between 1 and 3 September, a second torrential rainfall was recorded at 293 millimeters. These were downpours such as had been rarely seen in 100 years. In order to gain an understanding of the role in withstanding floods of habitats after changes had been made, we conducted tests in three streams at the commune after the flood, using a stream in the First Brigade of neighboring Jingming Commune as a control. Geology, topography, proportion of cultivated land, and soil were very much the same in both places; however, characteristics of basin areas, stream gradients, and lengths of streams could scarcely be entirely the same. Comparison after making changes showed that variations were the result of differences in forest cover and the volume of water impounded in projects. The comparisons are shown in Table 5.

Table 5. Comparison of Pertinent Paramaters for Flood Water Volume in Linshan Commune and in the First Brigade "9,2" in Jingming Commune

项目 1)	单位 2)	3) 林山公社			7) 净铭公社 8) 大队
		4) 北沟**	5) 南沟	6) 西沟	
9) 流域面积	23) 平方公里	8.94	7.22	4.38	2.84
10) 河沟平均比降	‰	14.23	10.27	10.52	29.63
11) 河坡长	24) 公里	4.94	4.98	4.34	2.94
12) 林木覆被率*	%	<44.6	~44.6	>44.6	3.8
14) 有水利能设施力 现滞洪	15) 25) 万方		21.2		
塘、堰	16) 25) 万方	25.56	5.13	8.0	2.88
合计	17) 25) 万方	25.56	26.33	8.0	2.88
18) 洪水流量(洪调法)	26) 方/秒	61.3	43.4	26.0	22.4
19) 每平方公里洪水流量	27) 方/秒、平方公里	6.86	6.01	5.94	7.89
20) 汇流参数 m		0.662	0.685	0.682	0.6
21) 修正后每平方公里洪水流走	27) 方/秒、平方公里	7.57	6.86	6.75	7.89
22) 洪峰模数削减百分数	%	4.1	13.1	14.4	

* Forest cover rate for Linshan Commune is 44.6 percent

**North stream basin area includes 2.95 square kilometers outside commune.

Key:

1. Item
2. Units
3. Linshan Commune
4. North Stream**
5. South Stream
6. West Stream
7. Jingming Commune
8. First Brigade
9. Basin area
10. Stream average
11. Slope
12. Length of stream gradient
13. Forest tree cover rate*
14. Ability of existing water facilities to halt flood waters
15. Reservoirs
16. Ponds and pools
17. Total
18. Volume of flood water (Flood regulation method)
19. Volume of flood water per square kilometer
20. Confluence paramater m
21. Post-adjustment flood water runnoff per square kilometer
22. Percentage reduction in flood peak modulus
23. Square kilometers
24. Kilometers
25. 10,000 cubic meters
26. Cubic meters/second
27. Cubic meters/second, square kilometer

Table 5 shows that after each of the streams in Linshan Commune had been altered, the flood water modulus became 4.1 - 14.4 percent less than in First Brigade, Jingming Commune. Comparison of North Stream in Linshan Commune with the two other streams shows that because of poor forest cover and the small, scattered nature of water storage, flood crest reduction capacity was weaker than in the other two streams. Water storage facilities in West Stream were small, but the forest cover rate in this area was best, so ability to halt flood waters was more marked. This shows that regulation of structures within a system are intertwined for an increase in resistance capabilities. Everyone is aware of the role of improved water and heat conditions in the recylcing of matter and the transformation of energy.

5. Change in Crop Cover For an Increase in Productivity. Crop cover is at the heart of the agro-ecosystem structure, and its evolution is manifested primarily in readjustment of the crop mix, in improvement of its function, and in increase in biomass, particularly in the increase of the part that humans want.

6. As a result of improvement in water, fertilizer, and soil conditions, and in the micro-climate, Linshan Commune's paddy rice area climbed from 279 mu in 1979 to 1,577 mu. A crop rotation system was set up in drylands in which wheat, corn, and sweet potatoes were rotated. Thanks to the role of the forest ecological system in providing livestock fodder (vine leaves) and fuel (stalks and stems), a livestock industry developed. This improved links in the material cycle to bring about an agricultural system in which farming, forestry, and animal husbandry were linked, and in which the mountains provided sustenance for the fields.

This was reflected in biomass. In 1976, yields per unit of area began to exceed the average for the county as a whole, and output increased tremendously. In both 1979, when a drought occurred, and in 1981, when a particularly large flood disaster occurred, grainfields per mu were larger than the average for the county as a whole. In 1981, yields were 3.5 percent greater than 1980. After a production responsibility system was instituted, the increase became even greater by one to four times.

The foregoing facts show that in the agro-ecosystem of Linshan Commune, regulation of elements in the ecological environment produced definite results. The vicious cycle was gradually reversed, and substantially the following situation developed: (1) a relatively stable structure and output, as well as definite resistance abilities, i.e., the ability to regulate matters oneself; (2) within the ecosystem, the matter and energy under man's control could be steadily replenished, and a certain amount

accumulated; (3) major elements in the ecosystem achieved an initial balance between supply and demand, and output, material resources, energy resources, and resistance became stable. This could be termed an embryonic ecological balance, which can be built, with effort, into a relatively stable system.

Table 6. Comparison of Linshan Commune Grain Yields Per Unit of Area With Average Yields Per Unit of Area for the County as a Whole (Jin/Mu)

1) 年份	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
2) 林山	168	184	222	247	264	263	264	299	313	354	282	317	280	323	411	552	532	420	555
3) 盐亭县	188	206	229	252	262	271	262	292	301	323	285	301	298	336	341	369	372	378	438
4) 增(+)减(−)	−20	−22	−7	−5	−2	−8	+2	+7	+12	+31	−8	+16	−18	−13	+70	+183	+160	+42	+117

Key:

1. Year
2. Linshan
3. Yanting County
4. Increase or Decrease

The Way in Which the Mid-Sichuan Basin Achieved Agro-Ecosystem Equilibrium

The mid-Sichuan Basin was formed of purple sandy shale mostly in the Jurassic Period and the Cretaceous Period of the Mesozoic Era. It is bounded by a line running from Jintang, Zhongjiang, Santai, Nanbu, and Langzhong and divided into two parts. To the south all the way to both banks of the Yangtze River are widely spaced hills, while in the north hills one after another lead to low mountains. Linshan Commune in Yanting is located in the northern section quite far from large rivers (the Jialing and Fu rivers), and it is without large water conservancy facilities. It is in the part of central Sichuan Province that gets the least precipitation. Spring and summer drought, the alternation of summer heat and drought occur. Drought is the principal problem in this county and this region. The shortage of water, of fertilizer, of fuel, and of animal fodder limit development of agricultural production, and destruction of the ecological balance has placed the area in a vicious cycle. Experience has shown that the basic way in which to establish ecological balance in this basin is to make full and rational use of local resources. It is necessary to proceed from regulation of elements in the ecology to transform agricultural production conditions and to bring about four equilibriums[1] to establish a strong system for the transformation of matter and energy as a foundation for equilibrium in the agro-ecosystem. The specific ways in which this was done are as follows:

1. Planting of mixed alder and cypress forests. Use of the numerous bald mountains and grassy slopes in this region, and use of the easily weathered purple shale that is rich in calcium for afforestation with good quality local trees and cypress trees suited to the area. Application of the experiences of Linnong Commune's growing of alder trees up the sides of mountains whereby land in large depressions was plowed, harrowed, and leveled for the growing of sturdy seedlings (alder seedlings about 1 meter high being grown in a single year), which were transplanted to moist soil (or in soil brought in from elsewhere and watered if local soil was infertile). Different kinds of seedlings were either intermixed or planted in alternating rows on 12,000 mu of barren mountains for successful afforestation on the very first try, with a survival rate of more than 95 percent. Alder tree rapid growth provided shade for cypress trees when young. In addition, alder trees are a nitrogen fixing plant that is not part of the pulse family. An 8 year old alder tree contains 2.4 kilograms per mu of live nitrogen fixing nodules. Between the age of 5 and 9 years, an alder tree can produce between 1.49 and 8.48 kilograms of leaves per year[2]. Alder tree leaves have a 2.7 percent nitrogen content (dry weight), which helps cypress tree growth. Cypress trees grown together with alder in mixed forests grow 1.7 times more than do pure cypress forests. In 1978 and 1979, continuous, severe drought tested the alder trees and showed that in this area, a mix of alder and cypress trees is an effective match.

2. Impounding of Runoff to Regulate Water Among Areas and From One Year to Another. The lack of water in this region shows up mostly in the following ways: (1) Uneveness from one season to another, 78 percent of all precipitation occurring during summer and fall. (2) Uneveness from one year to another, the maximum being 1,180 millimeters (1953), and the minimum being 506.4 millimeters (1978). The relative monthly variation is 33 to 58 percent. (3) Uneveness in distribution from one area within a region to another. In South Stream, there is plenty of water, while a shortage exists in North Stream, and in West Stream no facilities exist for impounding water. (4) The area is far away from major rivers and has no permanent source of water for irrigation. Furthermore, the average annual 864 millimeters of rainfall for this region falls in a concentrated area. On average, for each mu of wetlands, there is an 18 mu area of concentrated rainfall; thus for each mu of cultivated land, there is an 8 mu area of concentrated rainfall. According to a survey conducted by the Chengdu Geology Academy, this region annually stores 3 million cubic meters of water and replenishes about 600,000 cubic meters. The amount available to be tapped is between 250,000 and 400,000 cubic meters.

In this commune the average gradient is from 1:3 - 1:10, and for a long time runoff has been impounded to irrigate the fields. As of now, reservoirs (small second grade ones), ponds, dammed up streams, and pools have been built at 247 sites. They have a total capacity of 594,000 cubic meters and control concentrated rainfall over a 7.2 square kilometer area (dammed up streams not included in the figures), which is 49 percent of the commune's total area. When these projects are functioning to the full, during years of abundant rainfall they more than satisfy irrigation needs. In normal years, they just satisfy needs, and in drought years, they supply only 45 percent of the water needed for irrigation. Analysis shows that in years of moderate drought, the runoff is 68,500 cubic meters per square kilometer, but that current water conservancy facilities impound only 17,900 cubic meters or 26 percent of the annual runoff. Irrigation, however, requires 39,800 cubic meters per square kilometer or 58 percent of the runoff. By taking a series of actions and doing some short-range planning, with little expenditure of labor, use of only a small amount of land, and for a small investment, the water storage capacity could be increased to 232,000 cubic meters for substantial solution to the water supply problem in years of moderate drought,with virtual balance between supply and demand.

In order to even out supplies among regions and among projects, insofar as possible, all the reservoirs, ponds, dammed up streams and ditches should be connected into a water conservancy network. The commune has already established an irrigation pumping station, inverted siphons, and a collection of ponds on the Sancha River in order to regulate the distribution of water between the water-plentiful South Stream and the water short North Stream.

In view of the great changes in rainfall patterns from one year to another in this region, and following a line of thinking of "when water is available, plan for drought; and when water is not available, prepare against flooding," during years of plentiful water, water should be impounded for use in dry years. Similarly in years when water is in short supply, vigilance should be maintained against damage from floods and waterlogging and water should be stored early in order to even out supplies over several years. Were a pumping station to be added at Yangjia Curve alongside the first station that already exists there, water could be diverted to storage in years of moderate or worse drought. The reservoir on Tangcun Stream has a 212,000 cubic meter storage capacity, but an area of concentrated rainfall of only 1.26 square kilometers. In years of moderate drought, runoff amounts to 86,300 cubic meters. Following construction to impound flood waters, 33,600 cubic meters of flood waters could be diverted to the reservoir. However, a reservoir with a capacity greater than 92,100 cubic meters could satisfy needs for regulating water to

fill the reservoir.

3. Farmland Improvement, Soil Improvement, and Straightening Out the Ditch System

During 1971 and 1972 Linshan Commune began to change 1,900 mu, or about 50 percent of its drylands, making infertile soil fertile, and terracing slopes. This together with year-round carrying of sandy soil for application to the surface of the fields brought rather good results. Small plots on the same level were connected into large plots of cultivated land, and pebble strewn land was transformed to expand the growing area. At the same time, the lower soil layers were improved, and soil was brought from elsewhere or assembled to thicken the soil layer for improvement in the soil's water retention capacity. For example, comparison of soil quality at a depth of 40 and 70 centimeters on level ground behind First Brigade with moderately loamy purple soil showed the first time rainfall was greater than 15 millimeters that the surface layer of the soil to a depth of 40 centimeters could retain 1 to 2 percent more water. Following terracing of slopes, scouring was reduced. Between 12 and 14 July 1981, for example, when more than 306 millimeters of rain fell, on terraced slopes with a gradient of 5 - 7 degrees the soil surface was eroded by as much as 20 millimeters while on flat teraces, erosion was not noticeable. About 300 mu of had their soil quality changed, and 470 mu of fields were changed from small one to big ones, or main water courses filled in so water flowed through the middle of them in a corelation of field transformation with the straightening out of the ditch system. In North Stream where the ditch system was readjusted rather well, during flooding both First and Sixth Brigade had little loss.

4. Capitalizing on Advantages and Avoiding Disadvantages in Readjustment of the Farming System. In view of the hot, dry summers, the frequency of summer drought, and the rapid rise in temperature, spring sown crops are usually sown early, and seedlings propagated and transplanted early so as to avoid summer drought. The sowing of corn, for example, is advanced to mid or late March in order to assure tasseling by 10 June. Sweet potatoes are sown sparsely in a low bed pit covered with mulch to produce early seedlings, and usually wheat, corn, and sweet potatoes are planted in separate strips. In addition, early and intermediate corn are intercropped, and if the dog days of summer are not too dry, an additional crop of intermediate corn may be harvested. Creation of farming systems suited to weather conditions is a matter deserving attention in the agroecosystem equilibrium.

The mid-Sichuan basin holds very great potential. Linshan Com-

mune's experiences may be spread northward, and an agro-ecosystem with a rational structure can be built.

Conclusions

The equilibrium of agro-ecosystems must be looked at in terms of regional characteristics, and full and rational use of resources carried out in stages over a period of time. At the present stage, most important is reversal of the vicious cycle, the use of local natural agricultural resources, transformation of plant growth factors that can be regulated, increase in soil fertility, achieving a balance between supply and demand of water and manure, and establishment of a powerful system for the cycling of matter and the transformation of energy. Also required is readjustment of the internal structure of biological colonies and a rational pattern for farming, forestry, and animal husbandry to increase the rate of transformation of matter and energy. Serious attention should be given structural readjustments within the system, mutual advancement among individual elements, improvement and stabilization of conditions for the transformamtion of matter and energy , and improvement of the system's capacity to resist in order to create conditions for the gradual building of an agro-ecosystem of low consumption and high productivity. A unified effort to improve and upgrade conditions, and efficiency for the cycling of matter and the transformation of energy, and guaranteeing supplies of matter are major ways in which to realize equilibrium in the agro-ecosystem at the present stage.

FOOTNOTES

1. Zhang Xianwan, Exploration of Ways To Maintain an Agro-Ecosystem Balance in the Mid-Sichuan Basin; Collection of Papers From National Conference on Tropical and Semi-tropical Mountain Area Basin Ecological Equilibriuma, Science Popularization Press, 1981.

2. Deng Tingxiu, Preliminary Research on Alder Leaf Quantities, Journal of Ecology, March 1981

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CSO:5000/4144

NATIONAL SYMPOSIUM ON AGRO-ECOLOGY HELD

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1 1983 p 6

[Article by Zhuang Jiping [5445 1323 1456]: "Second National Academic Symposium on Agro-Ecology Held in Shenyang"]

[Text] The Second National Academic Symposium on Agro-Ecology was held in Shenyang from 11 to 16 October, 1982. The symposium was under the leadership of the Chinese Ecology Society, and was arranged for and sponsored jointly by the Forestry Pedology Institute of the Chinese Academy of Sciences, the Shenyang Academy of Agricultural Sciences, and the Liaoning Provincial Academy of Agricultural Sciences. A total of 88 delegates from 16 provinces, municipalities, and autonomous regions attended the conference, including those from research organizations under the Chinese Academy of Sciences and the Academy of Agricultural Sciences, concerned institutions of higher learning, industrial departments, and comrades from the editorial departments of the Agricultural Press Journal of Ecology, and Ecology Magazine.

This conference provided the first summarization since last year's Nanjing conference of the diligent work done by agro-ecological workers throughout the country during the past year, and it was also the first review of the results of agro-ecological research in recent years. During the conference, delegates from all over engaged in wide-ranging academic exchanges through academic reports, small group discussions, and debates on specialized topics. They also visited some advanced agricultural models in suburban Shenyang, and inspected Qianshan Prefecture's natural ecosystem. This conference received the vigorous support of Liaoning provincial and Shenyang municipal parties concerned. During the conference, leading comrades of the Liaoning Provincial Science Society visited the conference in person to see the delegates. Overall, the conference was rather dynamic and vigorous, and achieved anticipated results.

The conference received a total of 55 papers on subjects such as regional agro-ecosystem structures and functional research (anal-

ysis of the flow of matter and energy), and on agro-ecology research methods, which accounted for about half the total number. Others dealt with strategic issues such as climate and crop ecology, the soil ecology system, ago-ecology research, and the development of agriculture. Papers presented at this conference were more numerous and of better quality than those presented at the first conference. This was attributable particularly to comrades having done solid work from which they derived a fair amount of firsthand data with the results that the content of reports was rather substantial.

As a result of conference delegates' wide-ranging discussions and diligent exchange of views, the conference made some proposals on the future direction of research work on the agro-ecology and on academic activities. It also entrusted the Nanjing Pedology Institute of the Chinese Academy of Sciences, the Nanjing Academy of Agricultural Sciences, and the Jiangsu Provincial Academy of Agricultural Sciences with the task of making arrangements jointly for the running of an agro-ecological system research study class in Nanjing during 1983. It entrusted the South China Academy of Agricultural Sciences with making periodic translations on agro-ecology. In addition, it hoped that that the Beijing Agro-Ecology Experimental Station established by the Chinese Academy of Agricultural Sciences would be built and begin work as quickly as possible to provide impetus to agro-ecology research work throughout the country.

The conference proposed that the third agro-ecology academic symposium be held in Sichuan Province during 1984, and entrusted preparations for it jointly to the Sichuan Provincial Ecology Society, the Pedology Institute of the Chengdu Branch of the Chinese Academy of Agricultural Sciences, the Chengdu Biology Institute, and the biology department at Sichuan University.

Finally, the conference passed a written proposal put forward by departments concerned on control of rodent damage in farmlands, and maintenance of equilibrium in the agro-ecology.

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CSO: 5000/4144

SYMPOSIUM HELD ON AGRO-ECOLOGY ECONOMICS

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1 1983 p 64

[Article by Wang Chun [3769 5028]: "Fengdu County, Sichuan Province Convenes Agro-Ecology Economics Symposium"]

[Text] From 3 to 8 October 1982, Fengdu County in Sichuan held a symposium on agro-ecology economics. This symposium was held at the suggestion of the Fengdu County Agricultural Zoning Office, the Research and Investigation Office of the County CPC Committee, the county science committee, the county agricultural office, the county planning committee, the county finance office, and the county science society, and was vigorously supported by the County CPC Committee, the Standing Committee of the County Representative Assembly, and the county government. The 150 delegates to the meeting came from the agriculture, forestry, animal husbandry, meteorology, water conservancy, biogas, planned parenthood, agricultural economics, and finance and trade fronts throughout the county, and also included scientific and technical personnel as well as leading cadres in the frontline of agricultural production in areas, communes, and production brigades concerned. The symposium received a total of 75 papers and survey reports. Not only did scientific and technical personnel such as agronomists and agricultural economists prepare papers, but county and area leaders as well as departments, commissions, bureaus, and offices concerned presented them. More gladdening was that a peasant in Taihe Commune wrote a paper that he submitted to the symposium for exchange.

This symposium was held on the basis of all round development of natural agricultural resources and socio-economic surveys. Discussions fell into the following four categories:

First, a large amount of the symposium's factual data testified to the disastrous consequences of many years of one-sided pursuit of economic objectives in leading agricultural production to the neglect of ecological equilibrium. One such consequence was serious erosion. A second was frequent disasters and a very great

decline in ability to withstand disasters. A third was reduction in beneficial plant and animal resources, and the proliferation of harmful plants and animals. A fourth was the slowness of economic development.

Second, in order to implement the spirit of the 12th Party Congress and the need to usher in a new situation in agricultural production, a unified conception of ecology economics must be established and a good job done in the zoning of agricultural ecology economics. The task of agro-ecology economics zoning should be a solution to relationships between living creatures and their environment, to relationships between ecosystems and economic systems, and to relationships between nature and society, thereby establishing an optimum agro-ecosystem in which man adapts to nature, is in harmony with nature, and transforms nature. A management system encompassing ecology, technology, and economics centering on management of populations of living creatures should be established. In this connection, the symposium received quite a few papers dealing specifically with economic issues in the county's development of strengths. These papers maintained that production of citrus fruits, preserved kohlrabi, tung oil, raw lacquer, rhizomes of Chinese goldthread [Coptis chinensis], silkworm mulberry, and paddy rice was ecologically suited to the county, technically feasible, and economically rational, and merited great development.

Third, in order to adapt to new circumstances in production responsibility systems whereby individual households contracted sole responsibility for completion of specific tasks, some papers proposed that so long as a socialist orientation was maintained and large scale agriculture provided a backdrop, a garden style ecology economy in which individual household operations are paramount should be vigorously pursued. Small wooded groves, small fruit orchards, small vegetable gardens, small bamboo groves, small fish farms, small poultry and livestock farms, and small processing plants run by households should be established. Discussions brought out the point that were such a garden agro-ecology economy to pervade every mountain and village, the ecological environment would be greatly improved; the rural economy would see very great development; and levels of productivity would rise greatly.

The symposium made some suggestions about how further to improve the quality of agricultural zoning and to spread knowledge of ecology economics.

The County CPC Committee gave this meeting high marks, maintaining that "this is a fine beginning in the ushering in of a new situation in the county's agricultural development." The Economic

Institute of the Chinese Academy of Social Sciences invited the county to participate in the first national symposium on ecology economics to be held from 6 to 13 November at Nanchang, Jiangxi. The county's application of ecology economics concepts in guiding economic zoning, and experiences in holding a symposium on ecology economics was praised by experts, scholars, and leaders attending the conference.

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SHELTER FOREST ROLE IN ENVIRONMENTAL PROTECTION DISCUSSED

Tianjin NONGYE HUANJING BAOHU [AGRICULTURAL ENVIRONMENTAL PROTECTION] in Chinese No 1 1983 pp 26-28

[Article by Zhu Jingwei [4281 0513 0251], Institute of Forestry and Pedology, Chinese Academy of Agricultural Sciences: "Role of Shelter Forests in Improving the Farmland Ecological Environment"

[Text] The old agricultural ecological system formed over the course of several thousand years in China's vast farmland areas poses very great obstacles today in increasing agricultural productivity. It is a long way from meeting needs for the modernization of China's agriculture, and its structure and components must be readjusted. Both foreign and domestic research has shown that once shelter forests enter the agricultural ecosystem, environmental quality improves, and levels of agricultural productivity rise greatly. Shelter forests not only play a tremendous role in regulating the climate, holding water, preserving the soil from erosion, blocking winds and stabilizing sands, and preventing environmental pollution, but also insure consistently high agricultural yields and are able to improve crop quality. Consequently, building of an agricultural ecological system in which a farmland shelter forest system is the backbone is one important way in which to change the undiversified, small scale agricultural economy that has endured in China for several thousand years.

As the building of farmland shelter forests got underway beginning in the 1950's, experiments and observations correlated to China's production realities were launched in the use of shelter forests to improve the farmland ecological environment. The research was fairly wideranging and included the dynamic effects, the thermal effects, and the hydrological effects of forest belts. An evaluation was made of the role farmland shelter forests played in transforming nature and in promoting agricultural production. This provided scientific data for changes in consolidation of, and improvement of existing shelter forests, and for planning and designing of new shelter forests to be built in the future.

1. Dynamic Effects of Shelter Belts

The dynamic effects of shelter forests are the main function of forest belts. These effects are manifested in the effective diminution of wind speed, and changes in the nature of air movements, which indirectly influences other elements in the microclimate such as changes of individual components in water heat balance, as well as wind erosion and deposition of soil, and biological characteristics of plants. Within the realm of forest belt protection, as a result of reduction in wind velocity, farmlands and crops escape tattering by the wind, and lashing and burial by sand, and an outstanding ecological environment is established for crop growth. Experiments have shown that a forest belt perpendicular to a destructive wind diminishes wind velocity on the leeward side over a distance that is about 50 times the height of the trees; on the windward side, the forest belt diminishes wind velocity over a distance about 10 times the height of the trees. Moreover, on the leeward side, it reduces wind velocity to the point where it does not cause a disaster, providing effective shelter over a distance that is 15 to 30 times the height of the trees. The higher the wind velocity, the more striking the role of shelter. China is a vast land with extraordinarily abundant climatic resources in which, as a result of the the monsoon climate, disastrous weather frequently occurs that impairs agricultural production. North China is regularly scourged by hot dry winds that reduce yields by 20 to 30 percent. In south China, damage from typhoons and cold dew winds may reduce yields by 30 to 40 percent. Large scale building of shelter forests can prevent or reduce such damage. In May 1976, for example, a great windstorm such as has rarely occurred struck Zhaowuda Banner in Nei Monggol with a maximum wind velocity of 30 meters per second. Seventeen percent of the banner's 13.2 million mu of cultivated land was damaged, yet 4 million mu of cultivated land protected by shelter belts and grasslands were not damaged. In May 1976, hot winds blew for 3 days on end in Xiuwu County in Henan Province. This was just at the time when the wheat was in the in-the-milk and wax ripe stages of growth. The hot winds caused the green leaves of plants to wither and grain to dry in the glumes. Yields fell. However, at Xiaowenan Production Brigade in the same county, thanks to protection provided by the forest network, wind velocities fell to below 3 meters per second, air temperature fell to 2° C, and relative humidity rose 1.8 times, completely changing the character of the hot dry winds. In northern Liaoning Province, five rows of forest belts laid out some distance apart cut wind speeds by 25 percent within a distance 30 times the height of the trees. In this region, where windblown sand is a fairly serious problem, spring sowing can be

done on time and destruction of seeds is stopped within the area protected by the forest belt. It is not hard to see from the foregoing facts that the effectiveness of forest belts in reducing wind velocity lies primarily in the elimination of the wind's physiological damage and mechanical damage to crops, thereby creating a fine ecological environment for the crops that assures consistently high crop yields.

2. Thermal Effectiveness of Shelter Belts

The thermal effectiveness of shelter belts is manifested primarily in changes in temperature within a certain part of the protected area. Forest belts can play a role in preventing cold damage and in advancing and lengthening the growing season. Not only can forest belts reduce wind velocity, but through the role of turbulence exchange they can also directly affect turbulent heat loss, heat loss through evaporation, the rate of change in temperature, and change the homogeneity within the shelter belt protected area. Measurement taken in the area of the Songhua and Nen rivers in northeastern China; at Zhanggutdai in Zhangwu County, Liaoning Province; in Zhaowuda Banner in Nei Monggol; in Yanling, Henan Province; in Yanbei, Shanxi Province; and Ningxia and Xinjiang provinces on the effects of shelter belts on temperatures showed that during spring, autumn, and winter, shelter belts increase temperatures, but lower them in summer. The general extent of increase or decrease in temperature was about 1 or 2 degrees centigrade. In the area of the Sunghua and Nen rivers, increase in temperature during spring was greatest at 6° C., and in Yanling, Henan Province, decrease in summer temperature was greatest at 4° C. The role of forest belts in increasing temperatures is manifested in spring crops have not yet begun to grow and in fall when crops ripen. Because of the blocking that forest belts provide, in spring, turbulent heat exchange is fairly weak. As a result, ground surface heat is not readily dissipated into the atmosphere, and so the air temperature in fields and the soil temperature rises. This help seeds sprout earlier, emerge from the ground, and grow. In fall when crops ripen, energy expended through soil evaporation and crop transpiration diminishes remarkably, and turbulence exchange in forest networks is fairly weak. This helps air temperatures rise. Data collected in Liaoning and Heilongjiang show that in farmland protected by forest belts, the growing season for both millet and corn was generally more advanced than for places not protected by forest belts, and the time of ripening was 5 to 8 days earlier. This is extremely important for the western part of China's northeastern provinces which are prone to damage from early frost.

Shelter belts play a remarkable role in guarding against advectional frost. In Bashan Prefecture in Hebei Province, for example,

after building of shelter forests, damage from advectional frost diminished. During an early frost in 1972, on the leeward side of the forest belt beyond 150 meters, frost was severe and yields were only 30 jin per mu, while within 150 meters, yields were 170 jin per mu. In March 1976, Xiaowenan Production Brigade in Xiuwu County, Henan Province had a late frost, but damage to wheat plants within the shelter belt protected area was only 40 percent and there was no withering and dying. However, in an area not protected by a forest belt that was used as a control, all the wheat died. After Yanling County in Henan Province put in a forest network, the frost-free period was extended by about 10 days. Clearly, forest belts play a remarkable role in diminishing damage caused by advection frost and low temperatures. However, forest belts cannot raise the lowest temperatures within the protected area that are caused by radiation of ground heat.

3. Hydrological Effectiveness of Forest Belts

The hydrological effectiveness of forest belts is manifested in changes they bring about within a certain sheltered area in hydrological and meteorological factors such as evaporation, humidity, snow accumulations, precipitation, run-off, and ground water. Most of the present large area farmland shelter forests have been planted in areas where the climate is quite hot and dry and there is much windblown sand, such as in the western part of China's northeastern provinces where strong southwest winds rage in spring causing rapid evaporation of soil moisture and drought that damages crops and delays sowing. Thus, improvement in farmland moisture is another important function of shelter belts. When protected by forest belts, farmland crop transpiration and soil evaporation decline, and air humidity rises sharply as compared with open spaces. Measurement data show that evaporation from water surfaces and from the soil falls by 10 to 40 percent within areas sheltered by forest belts, and crop transpiration diminishes 25 to 40 percent. Lowering of evaporation and raising of air humidity function to ward off drought and maintain soil moisture.

Shelter belts also have a definite affect on precipitation. They do not have much affect on vertical precipitation, but they do play a beneficial role in the distribution of precipitation. Moreover, shelter belts can give rise to large amounts of horizontal precipitation. In foggy places, the blocking that forest belts provide can retain some of the water in the fog. In coastal and river valley areas, in particular, this role of forest belts is pronounced. In addition, forest belts expose large areas of branches and leaves on which dew, frost, mist, and rain can collect in larger amounts than in open spaces during nights when cooling occurs.

Shelter belts also have a very great affect on snow accumulations. Because forest belts reduce horizontal wind velocity and dynamic speed, snow falls fast and heavy in the vicinity of forest belts resulting in the accumulation of a thick layer of snow, the amount of accumulation determined largely by the nature of the forest belt. Since different kinds of forest belts play different roles in diminishing wind velocity and turbulence exchange, their pattern of snow accumulation also differs. Snow accumulations are thickest around the windward edge of dense forests; however, within the forest belt shelter area, the pattern of snow accumulation is very uneven. In spread out forest belts, snow is thickest on the windward edge of the forest, and the forest network collects a fairly thick accumulation of snow. In ventilated forest belts, since wind velocities are fairly great beneath the crowns of trees, the pattern of snow accumulation within the forest network is fairly even. The amount of snow that accumulates in forest belts increases as the number of rows of trees in the forest belt increase and as their distance apart decreases, and snow accumulation within the area protected by the forest belt is relatively reduced. Generally speaking, when 3 to 5 rows of trees have been planted at a distance of about 2.5 meters between rows and in belts 300 to 400 meters wide to form a shelter belt with a ventilated structure and a dispersal of about 0.5, not only is the depth of snow accumulation greatest, but the pattern of distribution within the forest network is even, and increase in soil moisture most marked.

Forest belts also have a remarkable affect on countercurrents and ground water. Forest belts with well-developed root systems increase the roughness of the ground surface and the porosity of the soil, thus reducing the runoff coefficient. In places where large amounts of snow fall, and particularly on afforested slopes that act as shelter belts, this function is extremely marked. Forest belts promote increase in horizontal precipitation and reduce runoff, and this is ultimately manifested in rather good replenishment of the ground water table. However, in irrigation areas, forest belts can play a role in lowering the ground water table. In irrigation areas the farmland ground water table is high in the vicinity of irrigation ditches and low in the center of the area. Because irrigation ditches slope towards farmlands, the underground water table becomes concave. When there is a forest belt along the ditches, the ground water table becomes convex. Throughout the entire growing season, the water table beneath the forest belt along the irrigation ditches is lower than in the fields, and this plays an extraordinarily marked role in preventing or diminishing soil salinization and waterlogging on both sides of the ditches.

Shelter forest are able not only to prevent or reduce damage to

crops resulting from dynamic forces, but also affect the microclimate, thereby causing other changes such as soil fertility, and the distribution of soil micro-organisms and numbers of insects. This multiple affect is manifested ultimately in an improvement in both the quantity and quality of farm yields. Representative sampling done in Longjiang, Tailai, and Anda counties in Heilongjiang Province showed that wheat yields were 19.4 percent greater, and soybean yields 26 percent greater, in areas protected by forest belts as compared with open areas. Corn yields increased by 13.1 percent, and gaoliang yields increased by 15 percent. Furthermore, grains were plump and quality was better. At Jiusan Farm in Heilongjiang Province, wheat and soybeans growing in areas protected by forest belts were surveyed. Statistical data for a 10 year period showed an 18.4 percent average increase in wheat yields, and an average 6.2 percent increase in grain weight. Soybean yields increased 17.5 percent; bean weight increased 7.8 percent; and the growing season began 2 to 4 days earlier than in open spaces. In wheat growing areas of the North China Plain, wheat yields increased by 10 to 58.8 percent in areas protected by forest belts, thanks to the effective shelter belt prevention or reduction of damage caused by hot dry winds. Forest belts in north China have been effective in increasing yields of many crops, the extent of increase commonly being 10 to 30 percent. Obviously forest belts have been extremely effective in improving the farmland ecological environment and in increasing crop yields. Shelter forests have become an indispensable integral part of the farmland ecological balance. The building of a farmland shelter forest system will inevitably play an even greater role in hastening the country's agricultural modernization, in promoting a farmland ecological balance, and in raising the people's standard of living.

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SHANDONG MOUNTAIN, PLAIN ECOLOGIES LINKED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983 pp 51-54

[Article by Zhou Guangyu [0719 0342 5940], Biology Department, Shandong University: "Restoration of Mountain Forests Is The Guarantee For Development of Agriculture in Plains Areas"]

[Text] 1. The Relationship Between the Mountains and the Plains

The ecological viewpoint holds that mountains, waters, forests, fields, and roads are a totality. They form a system. Agriculture on the plains is limited mostly by conditions on the plains; nevertheless, unless mountain regions are taken into consideration, the plains will certainly be affected. In 1981, after Sichuan Province experienced a particularly severe flood disaster, the province's leading comrades pointed out that this flood was attributable not only to torrential rains caused by the circulation of atmospheric currents but also, in large part, to destruction of forests in the upper reaches of the Yangtze River. Erosion there was serious, and with the first torrential rains, a mountain torrent exploded that sent waters rushing unchecked for a thousand li. There is not the slightest doubt that destruction of the forests directly hurt development of agriculture in plains areas.

For a long time Shandong Province has not protected its mountain forests. The pace of their revival has been exceeedingly slow, and today the province's forest cover rate is only 8.9 percent. Even today, senseless felling of trees, clearing of land for farming and destruction of pastures goes unchecked, and erosion is extremely serious. We believe that one of the important things that Shandong Province can do for development of agricultural production in plains areas is to call a halt at once to the destruction of mountain area forests and to further revive and develop forests. We have no intention of claiming that "forests are omnipotent," but we truly believe that unless forest cover in mountain areas is revived, development of agriculture in plains areas cannot be guaranteed with assurance.

Shandong Province has a land area of 229.26 million mu of which mountains and hills account for 34.9 percent, and plains, lowlands, lakes and streams account for 65.1 percent.

Central Shandong, and the Shandong promontory are largely mountains and hills, while northwestern and southwestern Shandong is a broad and level plain with some lowlands and hills with gentle slopes. In south central Shandong, the terrain is fairly rolling. Here the Taiyi mountain range stretches in an unbroken chain to the east and west, and around it low mountains and hills descend gradually to the plain. Water systems that rise in the south central mountains of Shandong Province fan out toward the plains. The Shandong Promontory is largely gently rolling hills, with the Laishan mountain range dominating the middle of the promontory, and hills in its northwest. Streams on the promontory flow north and south to the plains. Between the promontory and south central Shandong lies a denuded alluvial plain, traversed by the Jiaolai River. Northwest and southwest Shandong are large plains formed by alluvium from the Yellow River, and are an integral part of the great North China Plain. The Lintancang Plain in the lowerreaches of the Yi and Shu rivers of south central Shandong are a part of the plain of the Yellow and the Huai rivers, while the Tailai Plain in the Wen and Si river basin are a continuation of the southwest Shandong plain. The northwest part of the Shandong promontory also has the Penghuangye Plain, which is fairly small in area.

All in all, the mountains, hills, plains, lowlands, and lakes of Shandong Province form an interrelated whole. At the same time, the streams that rise in mountain regions penetrate the plains from different directions and some of the plains' ground water comes from the mountain regions too. Surface water and ground water link the mountains and the plains in an inseparable whole.

2. Analysis of Ecological Factors

The various ecological factors of light, temperature, moisture, soil, topography, and living organisms are all natural resources for agricultural production. Natural resources constitute the material foundation for agricultural production; they are its raw materials. For this reason, ecological factors bear directly on the level of production.

Water is the main ecological factor in the life of plants, and it comes from precipitation. Shandong receives 550 - 950 millimeters of precipitation annually, enough for development of agriculture, and an amount suited to the needs of diversified farm crops. However, the distribution of precipitation is very uneven. Rainfall between June and August accounts for between 60 and 70

percent of the total for the year. The coincidence of water and heat at this time of the year is extremely favorable for agriculture; however, in plains areas where drainage is poor, it may lead to waterlogging disasters. Precipitation from March to May accounts for 10 to 15 percent of the annual total. At this time of year temperatures are rising; the air is dry; and plants needs for water are great. Frequently too little precipitation hurts plant growth. After September precipitation begins to taper off until February of the following year, amounting to only 18 to 30 percent of the year's total. Thus, each year is characterized by a "dry spring, a wet summer, and more dryness in the fall," which is very unfavorable for agriculture. In addition to precipitation being overly concentrated, it is often in the form of torrential downpours that last for an average 2 to 4 days. In hill regions, torrents often rage and cascade into plains lowlands where the accumulated water causes waterlogging, which causes very great damage to agricultural production.

The relationship between temperature and plants is an extraordinarily close one. In the southwestern and northwestern plains of Shandong, annual temperatures average more than 13° C. In the Yellow River delta, they are somewhat lower at less than 12° C. Accumulated temperatures for the province as a whole greater than 10°C range from 3,800°to 4,600° C, which is ample for temperate zone crops. During the growing season for plants, temperatures are fairly high, averaging 24° - 27° C in July. This distribution of heat is just right for crops requiring fairly high amounts of heat.

Light is one of the fundamental ecological factors for plant existence. Shandong receives an average of 2,290 - 2,890 hours of sunshine yearly, which is more than neighboring provinces to the south. This is extremely favorable for the growth of temperate zone crops.

Soil is the basis for plant growth. Soils of Shandong's plains are fluvo-aquic soils in a thick layer. The water table is fairly high. Since ancient times, Shandong's plains have been farmlands, and both soil quality and soil water content favor development of agriculture. One problem is that the soil has been cultivated for a very long time, but its fertility has not been sufficiently preserved, and its organic content is fairly low at less than 1 percent. Nitrogen is inadequate; complete nitrogen amounting to only about 0.05 percent. It is seriously deficient in phosphate, complete phosphate being about 0.1 percent. In addition, more than 16 million mu in the province is alkaline-saline soil, and soil alkalinity and salinity is unfavorable for agricultural production.

All the ecological factors of light, temperature, amount of precipitation, and soil condition are able to satisfy the needs of temperate zone agricultural production. Unfavorable factors are the distribution of precipitation and the drought and waterlogging disasters; this produces, plus the fairly low fertility and salt content of some of the soil. Soil fertility can be artificially regulated, and soil alkalinity and salinity can be influenced, to a certain extent, by water factors. Therefore, drought and waterlogging form the major contradictions in Shandong's agricultural production. These contradictions are restricted by natural conditions, and are closely bound up with human activities.

3. Effects on Agriculture of the Destruction of Forests

The economic benefits that forests provide in terms of their overall significance for the national economy and the people's livelihood far exceed the material benefits they provide. Once forests have been destroyed, the unfavorable consequences become apparent very quickly.

The erosion caused by destruction of forest cover has the most serious unfavorable effects on agricultural production. Shandong Province's eroded area covers 79.3 percent of its mountain and hill area, and annually more than 200 million cubic meters of soil are washed from the province's mountains and hills. The exposed rock area has increased to 1.91 million mu. This includes the Tai Mountain forest farm which was riven with gullies on the eve of Liberation and had very sparse ground cover. On almost 200,000 mu of mountainland were only 3,000-odd mu of pine and cypress, and the annual runoff amounted to 1.9 million cubic meters. The province's 175 large and medium size reservoirs annually receive 74 million cubic meters of silt. These include reservoirs used to regulate water sources, which have received 12.2 million cubic meters of silt, or 8.8 percent of their capacity, in a period of 13 years. Data on the silting of Andi Reservoir show that after deducting the silt that damming of the upper reaches of rivers prevents from entering the reservoir over a 1,174 square kilometer drainage area, the average silting modulus for the period 1960-1973 was 2,483 tons per square kilometer. As a result of continued destruction of forests in the upper reaches, the average erosion modulus for the period 1973 - 1978 increased to 3,475 tons per square kilometer, a 39.95 percent increase during the last 5 years as compared with the previous 13 years. Statistics from Yantai Prefecture show that up until 1973, silting of 36 large and medium size reservoirs averaged 247.5 cubic meters per square kilometer per year. After 1974, however, it reached 3,588.1 cubic meters per square kilometer per year for a 13.5 fold increase. The silting of reservoirs and dams in

varying degrees directly affects their ability to prevent floods and provide irrigation.

Increasingly serious erosion has everywhere raised and widened stream beds in mountain regions. Some have been uplifted by about 2 meters or even as much as 4 - 5 meters, which is higher than the surrounding fields. A sudden large rainfall and there is nothing to hold back an innundation. Fields on both sides of streams are directly endangered as are fields in plains areas downstream. The scouring effect of silt in streams has broadened river beds. Many that had formerly been small streams only 2 or 3 meters wide have become 10 meters wide or even more than 100 meters wide during the past 30 to 40 years, taking away large amounts of cultivated land.

Once forests have been destroyed, the surface of the land lacks the cover to halt or restrain precipitation, and an overwhelming majority of precipitation converges into a powerful surface run-off that surges into plains areas. If the amount of precipitation is greater than usual, flooding results. Up until 1965, Jieshi Commune in Wendeng County had 50,000 mu of misty mountains where forests and grass grew in profusion. Even when torrential rains of more than 300 millimeters fell, no flooding occurred. During the 10 years of turmoil, the forest cover was destroyed, and during a torrential 355 millimeter rain in 1978, more than 300 embankments built in streams to restrain the flow were destroyed and 27 ponds became completely silted and silt destroyed 6,000 mu of prime farmland. Mountain forests once grew profusely in the eastern foothills of the Kunyu Mountains in Wendeng County, and a nature forest area covered 84 percent of the mountains and hills. On 27 July 1965, a torrential rainfall measuring 375 millimeters caused virtually no damage. Subsequently, after much of the forest cover had been destroyed, on 20 August 1978, during another torrential rain, this one measuring 350 millimeters, more than 1,000 grain processing workshops were washed away, 17 hamlets were drowned, 640 houses were demolished, and 12,000 mu of prime farmland and 11 dammed reservoirs were destroyed by floodwaters.

Once forests have been destroyed, the main means of storing moisture is lost. In each and every mountain area, and particularly in south central Shandong, where stream beds have been widened by tens of meters or even 100 meters, streams are no long able to carry flood waters away normally. When it rains, large amounts of water churn, and the flood crest becomes swift and violent, passing within a matter of a few hours. But several days flow produce little change, and once the rainy season has passed, the streams frequently dry up. Thus, though the annual volume of precipitation may be abundant; still, most of it becomes surface

runoff and is lost. As a result of the increasing destruction of forests since 1966, erosion has increased sharply making flood and drought disasters more frequent. Data from the Mengyin County Meteorology Station show a total of 12 fairly major flood and waterlogging disasters, and 11 droughts in the 30 years since Liberation. In the past 8 years, however, there have been four waterlogging disasters and 3 droughts. Their frequency has markedly increased since the period immediately following the founding of the People's Republic.

In addition, the intensification of soil erosion that follows destruction of forests not only damages prime soil, but also carries away large quantities of nitrate, phosphate, and potash fertilizers. Nitrate, phosphate, and potash accountd for about 1.9 million tons of the 120 million cubic meters of soil annually washed away in the Yi, Shu, and Si basins. Most of this is runoff in mountain regions, of course; but it also includes some from plains. In mountain regions, the surface soil is becoming increasingly infertile. This hurts the growth of herbaceous plants and of forests, which is bad for the conservation of water and soil, and also increases the risk of flood and drought disasters.

All this shows that the dangers to agricultural production on the plains that ensue from destruction of forests should not be underestimated.

4. Role of Mountain Forests in Agricultural Production

The greatest benefit to agricultural production that mountain forests provide is the conservation of soil and water to diminish damage from floods. Take the 200,000 mu Taishan forest farm area in which soil erosion had formerly been serious. In the period immediately following Liberation, after the mountain was closed off to people so forests could grow and afforestation was done, soil erosion became less and less. Between 1951 and 1956, silt run off totaled 500 cubic meters. Between 1957 and 1979, when the forest cover rate was 82 percent for the 145,000 mu forestland area, and when precipitation averaged 40 millimeters daily, within 2 hours after a rainfall waters ran clear down the mountain. Over the 23 year period, silt runoff was only 500 cubic meters. During the period immediately following construction of the Heilongtan Reservoir, the forest cover rate in the watershed it served was only 13 percent. Between 1945 and 1950, it received 130,000 cubic meters of silt, or an average of 21,700 cubic meters of silt annually. After the forest area was sealed off and the cover rate increased to 77.2 percent, silting of the reservoir between 1957 and 1980 totaled 60,000 cubic meters, an average 2,500 cubic meters annually. Mengyin County's Tianma

forest farm with an area of 54,000 mu had only 1,000-odd mu of sparse woodland run by a temple up until the time of Liberation. The rest of the area contained scraggly clumps of bushes and grass. Soil erosion was serious, and naked rocks protruded over a large area. During the 1950's the area was closed to people in order to nurture forests and grasslands, and trees were planted for afforestation. Today the forest is thick, and in this basin silting of reservoirs is very slight. Even in a situation of the area being 20 percent bare rocks and roads,or damaged by livestock hoofs, plus an additional 3 percent having been cleared for cultivation, the erosion modulus is still only 1,045 tons per square kilometer, and the eroded soil layer has a depth of 0.95 millimeters. Up until 1964, the 4,000 mu of barren mountains in Weishishan Production Brigade in the same county was seriously eroded. After the mountain area was closed and afforested, locust trees developed into a forest, the ground cover became dense, and although the land has a more than 25 degree slope, virtually no erosion occurs there. Over a period of 17 years, the dams that the brigade built in 1964 have experienced extremely slight silting. During the particularly severe 1981 drought, the dam continued to hold water for use in irrigation. Real examples of this kind are numerous throughout the province. Following afforestation, either silting of reservoirs decreases to the benefit of irrigation, or preservation of forests averts flood disasters.

In summary, the role restoration of mountain forests plays in reducing erosion and in averting flood disasters cannot be overlooked. Actual measurements have demonstrated that 5 million mu of forestland is able to hold as much water as a reservoir with a 1 million cubic meter storage capacity. In addition, the depth to which moisture penetrates forest soil is usually greater than the quantity of a large rainfall. A 1 centimeter thick cover of dried branches and fallen leaves can cut runoff by somewhat less than 10 percent more than bare ground, and can cut soil loss by somewhat more than 90 percent more than bare ground. This shows that the role of forest in the conservation of water holds great significance for regulating water used for agriculture.

Though forests cannot alter the circulation of atmospheric currents, their transpiration of large amounts of moisture is not unrelated to increase in the amount of rainfall. Every part of the country has data that correlates destruction of forests with reduced precipitation. In the more than 50,000 mu forestlands of the Tianma forest farm in Mengyin County in Shandong Province, annual rainfall is 150 to 200 millimeters more than in surrounding unforested areas, a difference of from 18 to 25 percent. Naturally this variation has to do with topography and other factors; nevertheless, that it exists in conjunction with forests may also have a bearing.

The role of forests in improving water conditions for use in agriculture and in controlling the alkalinization and salinization of soil in plains areas are indirect roles of forests.

5. Discussion

In discussing how to develop the natural resources of the plains of the Yellow, the Huai, and the Hai rivers, some people have recently suggested the need for all around contgrol of flooding, drought, waterlogging, and alkalinization. But sole reliance on engineering projects to do this is not enough; biological measures must also be adopted. This means afforestation and the planting of grass in the mountains at the upper reaches of all the rivers on the plain to reduce flooding and to husband water resources. This point of view is entirely correct.

In the zoning of China's vegetation cover, Shandong Province is a part of the temperate zone broadleaf deciduous zone, which is a climax zone for broadleaf deciduous forests. The present paucity of forests and the serious drought disasters are all in consequence of man's destruction of forests. The idea that restoration of forests can improve the environment and increase agricultural production should seemingly be beyond doubt. However, views are by no means unanimous. Some people point out that some countries that have large forest areas do not necessarily have high agricultural outpout. Granted that agricultural production levels result from numerous factors and are not determined solely on the basis of forest area; nevertheless, under China's circumstances, and more particularly Shandong Province's circumstances, in which mountain forests have been grievously destroyed and where distribution of annual precipitation is uneven, without a certain mountain forest area, consistently high yields in plains areas are very much impossible.

Today China has a 12.7 percent forest cover rate, but how large a forest area is needed in order to have it play a beneficial role in regulating nature? We believe it is not possible to generalize. It depends on natural conditions in individual areas and on the forest cover rate in surrounding regions. It differs from country to country and is not the same in different parts of the same country. Some people believe that a 30 percent figure should be considered. The country has proposed expansion of the forest cover rate to 26 percent for the development of forestry. This means that Shandong, as a part of the forest area, would have to provide a forest cover rate greater than 26 percent in order for the country as a whole to meet its goal. In the zoning of Shandong for forestry, a 30 percent forest cover rate has been proposed. Though this is not a high quota, the task involved is an arduous one. Because of the destruction of Shan-

dong's forests over a long period of time, and the severe erosion that has impaired agricultural production, restoration of mountain region forests is all the more necessary. Only a forest cover rate of much, much more than 30 percent will be able to play a fine role.

Views have differed over the years as to the role of forests in increasing precipitation, and we cannot point to certain observation and measurement data from any country or region to affirm or deny their role. This is because the relationship between forests and precipitation include numerous influencing factors of which regional characteristics are an extremely powerful one. One must proceed from the realities within a country to make a thoroughgoing and comprehensive exploration. Some people's argument that forests increase transpiration and decrease the discharge of moisture is not a convincing one.

Nowadays people have a better understanding of the role of forests in maintenance of ecological balance and in the promotion of agricultural production, yet views are not unanimous. Some people suggest that estimates on the role of forests are currently overly optimistic, while others note that the economic benefits derived from forests are not as high as those derived from commercial forests, and that commercial forests should replace existing forests. Still others believe the mountain region livestock industry should be increased. But none of these points of views is in keeping with realities as they exist in Shandong Province. We believe that unless mountain forests are revived and developed in the farflung plains areas of southwestern, northwestern, and other parts of Shandong, agricultural production cannot be assured, and when torrential rains occur, they will wreak havoc.

Though Shandong Province has proposed making forests the key link in mountain region production, linking farming, forestry, and animal husbandry in a program of diversified and all-around development; implementation has not been very vigorous, however. Many prefectures and counties have not done enough in the retrenchment of farming for reversion to forests, and have yet to bring to a complete halt the clearing of forest lands for farming. Some regions regard mountain areas as bases for development of a livestock industry and do not pen animals. In some places, milk goats are being pastured throughout mountain regions and causing great damage to forest trees. Foreign trade units buy up large amounts of locust tree leaves for export. During the season when trees are growing, the masses are mobilized to collect their leaves. This both damages tree growth as well as takes away leaves that would otherwise fall and fertilize the ground, and reduces their role in reducing runoff. Even communes and brigades that devote serious attention to forestry are preoccu-

pied mostly with the operation of timber forests and the building of commercial forests that are predominantly of the "four gardens" variety, giving insufficient attention to forests that store moisture and forests that conserve water and soil. .

For this reason, in studying and discussing development of agriculture in plains regions, one must proceed from a ecological viewpoint and consider the mountains and the plains as a unified whole. Only by restoring mountain forests can agricultural production on the plains be assured.

Principal Reference Works Consulted

(1) Yong Wentao [7167 2429 3447]: Floods and Forests, Forests and Man (Trial Publication), 1981

(2) Tan Qilong [6223 0796 7893]: A Look at the Importance of Protecting and Developing Forestry Looked at In Terms of the Sichuan Flood Disaster, Forests and Man (Trial Publication), 1981

(3) Huang Wanli [7806 5502 6849]: On Development of the Yellow River, Huai River and Hai River Plain Economic Entity, Guangming Ribao, 17 Apr 1982

(4) Editorial Board of Chinese Vegetation: Chinese Vegetation, Science Press, Beijing, 1980

(5) Huang Bingwei [7806 4426 4850]: Precise Assessment of the Role of Forests, Geographic Knowledge, Jan 1981

(6) Wang Zhenru [3076 2182 0320] and Huang Boxuan [7806 0130 3872]: Precise Understanding of the Role of Forests, Geographic Knowledge, Aug 1981

(7) Huang Bingwei: Further Discussion of the Role of Forests, Geographic Knowledge, 3 Feb 1982

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GUANGDONG PROVINCE'S FOREST ECOSYSTEM PROBLEMS AIRED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 1, 1983 pp 27-28

[Article by Zeng Tianxun [2582 1131 8113]: "Forest Ecosystem and Problems of Ecological Dislocations in Guangdong Province"]

[Excerpts] During the past 30 years, forestry has seen substantial development in Guangdong Province. The forest area has increased from 55 million mu in the period immediately following Liberation to 112 million mu, and the forest cover rate has risen from 17.6 percent to 33.9 percent. Nevertheless, 1979 statistics show consumption of 17 million cubic meters of forest resources in the province, which was more than the amount of growth. The forest area has decreased by more than 30 million mu since 1975, and the forest cover rate has fallen 4.5 percent. Thus, the existing forest cover rate is 29.4 percent, but it is unevenly distributed; forests are undiversified; and their quality is poor. "Four manys, four fews, and two lows" exist, by which is meant coniferous forests with a single kind of trees are many while deciduous forests or mixed forests are few; young and middle age trees are many, while mature trees are few; sparse scrub forests are many, while dense forests are few; timber forests are many while other kinds of forests are few; and both output per unit of area and amount of annual growth are low. Clearly the proportion of forest tree varieties is seriously unbalanced. For example, coniferous forests (particularly masson pine forests) account for more than 70 percent of the total, while deciduous forests account for less than 30 percent. Timber forests account for 90.2 percent of the total; economic forests account for 4.5percent; shelter forests account for 1.3 percent; nature preserves account for 0.2 percent, and others account for 3.8 percent. Among timber forests, young forests number 52.9 percent of the total; middle age forests number 37.7 percent; and mature forests number 9.4 percent. Average annual growth of forest trees is 0.1 - 0.2 cubic meters per mu, much less than the international figure.

For this reason, Guangdong Province's existing forests cannot

play a very great role in maintenance of the ecological balance. Imbalance in Guangdong's upland ecology during the past 20 years, the increasing deterioration of the natural environment, and destruction of forests are both directly and indirectly related. Because of the great erosion that has resulted from destruction of forests, the province has a seriously eroded area of more than 10,000 square kilometers distributed in more than 70 counties and municipalities. Its major rivers (including those that flow from neighboring provinces) annually carry 100 million tons of silt, 82 million tons of it in the East, West, and North rivers. The washing of silt from erosion into the lower reaches of rivers has turned large areas of high yield fields into yellow clay fields, cold waterlogged fields, or has even completely buried them. Numerous mountain pools, reservoirs, and river beds have become silted. A 1978 survey showed 85 mountain pools and 802 rivers in the province to be seriously silted. This has a serious affect on farmland irrigation and navigation.

Because timbering has been greater than growth, the situation in Guangdong Province's noted forests in the forestry counties of Lechang, Huaiji, Shixing, and Guangning has grown increasingly bad. No small number of ecological problems have arisen as a result. In Huaiji County, for example, reckless cutting and denudation, and the cutting of broadleaf evergreen forests over wide areas has brought about erosion, deterioration of soil fertility, a decline in the growth of Chinese firs, and even etiolation. This has weakened the function of the forests in regulating the hydrology, and has increased the threat of drought and waterlogging for farmland. Over a period of 14 years, the water level in the Zhongzhou River in Huaiji County has fallen 1.5 meters, and the Lanzhong River's flow capacity has dropped from 6 cubic meters per second to 3 cubic meters per second. Formerly 30 ton freighters could negotiate the Huaiji section of the Sui River in the spring, reaching Huaiji in 3 days, but now only 6 or 7 ton ships can pass, and it takes them 15 days to reach Huaiji. In Lechang, a mountain county that is "80 percent mountains, 10 percent water, and 10 percent fields," as a result of overcutting of forests year after year, erosion has taken place and the rivers are silted. During the 1950's, for example, it was still possible to float rafts and move boats on the Xikeng and Langtian rivers, but that became no longer possible in the 1960's. During the 1950's timber could be floated on the Feng River to Liangjiangkou, but that became no longer possible during the 1960's. Guangning County has always been famous for its abundant production of bamboo, but because forests have been overcut, damage from bamboo locusts is becoming increasingly severe. . Though outbreaks of bamboo locusts occurred during the 1950's, deciduous trees in which many kinds of birds nested were spread among the bamboo groves. These birds were natural enemies

of bamboo locusts, so the locusts could not become a pestilence. But because all the trees among the bamboo have been cut down recently, the birds have flown away. As a result, the area over which the bamboo locusts have become a pestilence has increased steadily, and stood at more than 40,000 mu in 1979. In Shixing County too, the volume of flow in rivers has dropped as a result of overcutting of forests, and drought and waterlogging disasters have become increasingly serious. Flow during the dry season in Shixing County's main river, the Mo River, fell from the 17 cubic meters per second of the 1950's to 3 cubic meters per second during the 1970. Consequently drought and waterlogging disasters have been more frequent. Spring droughts during 1972 and 1977 ruined 58,000 and 58,500 mu of farmland respectively. The fall drought of 1974 ruined 40,000 mu of farmland. A flood during June 1976 drowned 69,300 mu of farmland, and washed away 5,200 mu of farmland.

The destruction of forests throughout Guangdong may be traced to failure to act in accordance with natural laws for the past 20 years. The main reasons were as follows:

1. One-sided carrying out of a program of "taking grain as the key link," emphasizing grain to the detriment of forests, advocacy of everything to make way for grain, "no eating of grain sold by the state at uniform prices in forest areas," and irrational destruction of forests to expand cropland, leading to the destruction of forests, reclamation of the mountains for agriculture, and disaster at the foot of the mountains.

2. Unconcern about the amount of forest reserves and the amount of growth in setting right timber production quotas, which caused overcutting within quotas, and reckless cutting and denudation outside of quotas, leading to serious overcutting.

3. Because of the small grain rations and scant income of forest areas, only through more cutting of forests and intense removal of tree branches was it possible to maintain a minimum standard of living and reproduction. Thus, the poorer the area, the more cutting was done, and the more cutting, the more barren the area for the creation of a vicious cycle of the mountains being poor and the water coming to an end, the land infertile, and the people impoverished.

4. In order to solve problems in getting fuel and fertilizer, rural villages did not close off mountains to nurture forests, nor did they plan cutting according to growth or rotational cutting. This brought about reckless cutting and denudation, destruction of forest plant cover, and digging out of grass for use as fertilizer. Frequently forest fires broke out and damaged

forests.

5. Numerous changes in the system, and uncertainty about mountain rights and forest rights, particularly during the more than 10 years of turmoil and destruction caused by the ultraleftist line, occasioned reckless cutting and denudation, and the serious destruction of forest resources.

Guangdong Province's ecological imbalance must be turned around, and the vicious cycle transformed into a benevolent cycle. Serious attention must be given, first of all, to the important role of the forest ecosystem in maintaining a balanced ecology. Serious attention must be given the restoration and development of forest resources, and forestry must be run in accordance with natural and economic laws. Past lessons from "taking grain as the key link, elbowing all else aside, devoting attention solely to grain while ignoring all cash crops, destruction of forests to clear land in order to grow grain in mountain areas, and destruction of ecological balance, which have brought nature's retribution" must be learned. Modernization of agriculture requires that forestry be a major integral part of agriculture, and requires that farming, forestry, animal husbandry, sideline occupations, and fisheries be developed in an all-around way. General methods must be adapted to specific situations; land that lends itself to farming should be used for farming; land that lends itself to forests should be used for forests; and land that lends itself to animal husbandry should be used for animal husbandry. There should be economic diversification and no emphasis on one thing to the neglect of others.

Second, to make the most of Guangdong Province's advantages in being 70 percent mountains, 10 percent water, and 20 percent farmland, vigorous development of forestry is required to increase the forest cover rate from 29.4 percent to more than 50 percent so that its 70 percent of mountains will all be green. Therefore general methods must be adapted to the characteristics of individual tracts to do a good job of forest zoning. The forest cover rate of plains prefectures and counties should be more than 10 percent, of mountain prefectures and counties more than 40 per cent, and of forest region counties more than 60 percent.

Third, full use should be made of the role of the forest ecological system in maintenance of the upland ecological equilibrium. The uneven distribution of Guangdong's forests, and the lack of diversified varieties of forests must be changed. In the expansion of forest resources, there must be planned, proportional afforestation of coniferous, deciduous, and mixed forests, the use of timber forests, economic forests, firewood forests, live-

stock feed forests, water resources forests, forests to maintain the soil against erosion, farmland shelter forests, and protective forests. Attention must also be given the planting of trees in the four besides [beside streams, roads, villages, and houses], and to the tackling of mountains, rivers, farmlands, forests, and roads in a comprehensive way so as to bring into play the multiple benefits forests can provide. In view of Guangdong Province's superior conditions resulting from its location in the tropics and sub-tropics, deciduous evergreen forests should be developed.

Fourth, in order to protect and preserve biological resources and genetic resources, and as a convenience to and a base for scientific research, it is recommended that tracts of experimental forests for research be established in Guangdong Province, that natural forest preserves be enlarged, and that in existing natural preserves emphasis be given the protection of valuable animals. An increase in natural forest preserve areas in the low mountain tropical rain forests of Hainan Island, and a sub-tropical evergreen deciduous forest natural preserve in north central Guangdong are proposed.

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HU, DENG, ZHAO, OTHER LEADERS PLANT TREES

OW121520 Beijing XINHUA Domestic Service in Chinese 1213 GMT 12 Mar 83

[By reporters Li Shangzhi and Zhou Aiguo]

[Text] Beijing, 12 Mar (XINHUA) -- Today is Arbor Day in our country. This morning Deng Xiaoping, Zhao Ziyang and other leading comrades of central organs joined comrades of organs directly under the central authorities in planting trees on the southern slope of Mang Mountain beside the eastern dam of a reservoir near the Ming Tombs. The southern slope of Mang Mountain is an area designated for afforestation by organs directly under the central authorities.

"Persist in Planting Trees From Generation to Generation"

In March it is still a little chilly in northern China. Several minibuses sped over the dam near the Ming Tombs and stopped at the foot of Mang Mountain at a little after 0900. Hu Yaobang, Deng Xiaoping, Zhao Ziyang, Wan Li, Xi Zhongxun, Wei Guoqing, Ulanhu, Yang Shangkun, Yang Dezhi, Yu Qiuli, Song Renqiong, Hu Qiaomu, Chen Muhua, Deng Liqun, Gu Mu, Chen Pixian, Qiao Shi, Hao Jianxiu and other comrades got off the minibuses. Talking and laughing, they walked to the tree planting site with shovels in their hands. They immediately started digging and planting trees.

Comrade Deng Xiaoping, now 78, is an initiator of the all-people voluntary tree planting campaign. He and Comrade Hu Yaobang came to a hole dug for a sapling, and they both used shovels to fill in the hole around the sapling. Disregarding the dust spread over their clothes and hair and not taking time to wipe the sweat away, they quickly planted a Chinese pine.

Holding the shovel for support and looking in the distance, Comrade Deng Xiaoping sighed with emotion and said: "I came here more than 20 years ago when the reservoir near the Ming Tombs was built. It's been a long time since I was here last. How tremendous are the changes that have taken place here!" He said: "Planting trees everywhere and making the country green is a great undertaking in building socialism that will benefit our future generations. We must persist in it for 20 years, 100 years, 1,000 years, and never stop it for generations."

"Communist Party Members and CYL Members Should Set Examples"

When reporters asked Comrade Hu Yaobang to say a few words, he stood up straight, wiped the perspiration off his face, shook his hand and said with a smile: "I have come to plant trees and have nothing to say. Comrade Wan Li is the chairman of the Central Afforestation Committee. You can talk with him." And he went back to work with his shovel.

Comrade Hu Yaobang talked with a comrade by his side while he was working. He said: "Doing a good job in planting trees and covering the motherland with greenery is a major strategic measure to put mountains and rivers in order and safeguard and improve the ecological environment. To cover this place with trees, it is necessary to do a good job in planning and work in a down-to-earth way."

After hearing a report on plans for the area by comrades of the afforestation area assigned to departments under the CPC Central Committee, Hu Yaobang said: "The Ming Tombs is a scenic spot of the capital, and we must make up our minds to make it look good. It is necessary to have a good tree nursery. Trees should be planted close together. See to it that there will be trees, shrubs, grass and flowers to cover the entire area and turn it into a great garden of the capital."

Comrade Hu Yaobang said: "The Armed Forces have done a good job in afforestation, and we should all learn from comrades of the PLA. In the afforestation movement, Communist Party members and CYL members should set examples."

"Do a Better Job Year After Year"

While planting trees, Comrade Zhao Ziyang discussed with Comrades Gu Mu, Hao Jianxiu and others how to do a good job in afforestation. Looking at the green pines and cypresses on the hillside, Zhao Ziyang said happily: "The all-people voluntary tree planting campaign has achieved considerable success. This is only the beginning, and the tasks remain very arduous in the days to come. The all-people voluntary tree planting campaign must be carried on perseveringly and unremittingly.

"It is also necessary constantly to sum up experiences so as to make improvements, do a better job, and achieve greater successes year after year. I think that after 20 years of persistent effort, the lack of forest cover in our country will be greatly improved."

Comrade Gu Mu said: "The important thing in afforestation is management. Trees planted this year must not be allowed to disappear next year. Trees planted must be guaranteed to survive. After the trees are planted it is necessary frequently to go there and take a look, and see that they are properly managed."

"Afforestation Should Also Have a Responsibility System"

Comrade Wan Li was especially excited about the afforestation area. As soon as he got off the bus, he pointed to the faraway mountains and nearby river and told Minister of Forestry Yang Zhong and Beijing Mayor Jiao Ruoyu: "Before 1958, all you saw here were barren hills and ridges. In 20-odd years this area has been afforested considerably. Through continuous efforts by all of us, this area surely will become even more beautiful in the future." While shoveling dirt he said humorously: "Look at Hao Jianxiu, how hard she works. We must do solid work and compete with this model worker."

When the comrades by his side discussed how to do a good job in afforestation, Comrade Wan Li chimed in: "It takes 10 years to grow trees. In planting trees the important thing is persistence. Trees that are planted must be guaranteed to survive. I think afforestation should also have a responsibility system. It is necessary to promote the combination of responsibility, right and benefit."

"The PLA Should Make Greater Contributions"

Comrades Yang Shangkun, Yang Dezhi and Yu Qiuli were in military uniforms today. They worked so hard that their faces were streaked with sweat. The comrades around them urged them to take a break, but they said they were not tired. Comrade Yu Qiuli, who lost his left arm in the war years, worked very hard today, wielding the shovel with one arm. He said: "Even though I can't be regarded as a strong worker, I am still a worker and must also actively take part in tree planting." Comrade Yang Shangkun said: "The Fifth NPC Standing Committee decided to make 12 March Arbor Day in our country. The Fourth Session of the Fifth NPC adopted the resolution on launching the all-people voluntary tree planting campaign, calling on people of all nationalities throughout the country to demonstrate high patriotic enthusiasm, get into action and plant trees year after year persistently and unremittingly, like the foolish old man who

removed the mountains. The PLA is the people's own Army. It shoulders not only the great task of defending the motherland but also the great task of the motherland's construction. Comrades of the Armed Forces should take the lead in answering the call, modestly learn from the masses and do a better job and make greater contributions year after year in the great undertaking to plant trees and cover the motherland with forests."

CSO: 5000/4170

AFFORESTATION EVENTS, DRIVES IN FULL SWING

Youth Tree-Planting Drive Set

OW131415 Beijing XINHUA Domestic Service in Chinese 1210 GMT 9 Mar 83

[Text] Beijing, 9 Mar (XINHUA) -- The Central Greening Committee and the CYL Central Committee have recently decided to launch a voluntary tree-planting emulation drive among youth and children throughout the country in 1983.

The decision points out: A voluntary tree-planting emulation drive may be launched among youth and children and among collectives of youth and children in urban and rural areas, PLA units and various professions and trades throughout the country. The emulation drive calls for good publicity, good start, successful accomplishment of the task, paying attention to scientific afforestation and taking good care of forests and trees.

The decision points out: CYL organizations and greening committees at all levels should commend advanced collectives and individuals that emerge during the tree-planting emulation drive among youth and children. The Central Greening Committee and the CYL Central Committee will hold a national meeting on commending advanced collectives and persons in connection with voluntary tree-planting among youth and children at the end of 1984. Honor titles of "Shock Worker Who Makes the Motherland Green" will be conferred on the collectives and individuals that make remarkable achievements during the emulation drive.

The decision demands: Greening committees and CYL organizations at all levels should closely cooperate with each other and firmly strengthen their leadership over the voluntary tree-planting emulation drive among youth and children. CYL organizations should take various actions to organize voluntary tree-planting activities among youth and children. The Forestry Department should actively help youth and children solve actual problems concerning the voluntary tree-planting activities, such as problems of saplings, land and technical training.

City Beautification To Begin

OW142026 Beijing XINHUA in English 1558 GMT 14 Mar 83

[Text] Beijing, March 14 (XINHUA) -- A tree-planting drive will be launched in China's 236 large and medium-sized cities this year and in the next few years to provide the urban residents with a cleaner and more beautiful environment. The plan was announced today by Lian Zhong, vice-minister of urban and rural construction and environmental protection, at the first national conference for commending advanced sanitation workers and gardeners that opened here today.

Lian Zhong said China plans to cover by 1987 30 percent of the urban areas of 47 large and medium-sized cities with greenery, averaging three to five square meters per capita.

The cities include Beijing, Shanghai, Tianjin, capitals of the 26 provinces and autonomous regions, famous scenic and tourist centers and ancient cultural cities. By 1990, Lian Zhong said, 236 large and medium-sized cities should have reached the same target. At present, the tree- and grass-covered land of 108 cities, including Kunming, Shanghai, Tianjin and Xining, is below 10 percent of their total area.

China has now 140,000 workers specializing in tree planting and management as against 88,000 in 1978. Last year, people in 236 cities planted 95 million houng trees, planted grass on two million square meters and opened tree nurseries with a combined area of 900 hectares, thus improving the environment of these cities. According to statistics of the ministry, there are 13 Chinese cities where over 25 percent of the land area is covered with greenery, with Nanjing, Chengde and Zhengzhou reporting around 30 percent.

The ancient city of Xianyang with a population of 220,000 has drawn wide attention to its success in beautifying the environment. Thirty-six roads and streets in the city are lined with flowerpots and trees, including fruit and decorative trees. Its tree- and grass-covered area exceeds 20 percent. The people in the city have a total of 335,000 flowerpots, on average 1.5 flowerpots for each inhabitant.

In Beijing, people last year planted one million evergreens on wasteland at the foot of the Great Wall and on the barren hills near the famous Ming Tombs.

Rocket Base a 'Green Oasis'

OW111319 Beijing XINHUA Domestic Service in Chinese 0735 GMT 10 Mar 83

[By reporter Zhao Qi]

[Excerpts] Beijing, 10 Mar (XINHUA) -- The base from which China launched its first experimental carrier rocket in the Gobi Desert in northwestern China has become a green oasis with a lush growth of trees, singing birds and fragrant flowers.

This is the fruit of afforestation work done at the base by tens of thousands of sons and daughters of the Chinese nation since 1960. According to incomplete statistics, in the past 23 years they have planted some 2.7 million trees of various kinds, building vast shelterbelts totalling 1,150 mu with date trees and nurseries totalling 240 mu and afforesting land with some 400,000 trees. Looking down at the base's spring scenery from the elevator going up to the rocket-launching tower, this reporter saw luxuriant trees resisting ferocious wind and sand and protecting various modern instruments and equipment like green protective screens. Green trees surround the main building of the base, rocket-testing center, remote optical survey center, radars and other survey centers for obtaining rocket flight data, as well as the living quarters of scientists, engineers and technicians working on the base.

All of this has created the favorable conditions for carrying out experiments and drills in the launching of carrier rockets and for agricultural and sideline production on the base.

A woman meteorological commander who has observed Gobi Desert climate for more than 20 years told this reporter: In the past it was arid year-round and the air was very dry. In the spring everything was covered by windblown sand; in the summer, scorching sun brought the desert's surface temperature to as high as from 70 to 80 degrees centigrade -- high enough to cook an egg; in the winter, the temperature could go as low as some 30 degrees below zero centigrade. In order to transform nature and beautify the working and living environment, the base party committee issued a call for "greening the Gobi." From leading cadres to broad masses of scientists, engineers, technicians, workers and PLA commanders and fighters, everyone actively took part in afforestation of the Gobi and regarded it as a concrete action to rebuild the Chinese nation. After 23 years of hard work, the plan for greening the base was fulfilled. Trees planted on the periphery of the base are fully grown and tall and the office buildings and living quarters are surrounded by bushes year-round.

Recently, new tree-planting activities have started on the base, guided by the determination to build the base into a park and orchard. They will turn the desert into a place in southern China where "there are flowers in spring, shade in summer, fruits in autumn and green in winter."

RENMIN RIBAO Editorial

HK140709 Beijing RENMIN RIBAO in Chinese 12 Mar 83 p 1

[Editorial: "Speed Up the Building of the Motherland's Ecological Protective Screen"]

[Text] This year's tree-planting day has come. Hundreds of millions of Chinese people are working hard to plant trees and make the country green so as to build a fine ecological protective screen across the country.

Afforesting over 1 billion mu of barren hills as soon as possible is a primary task in the building of a fine ecological protective screen. The key to whether this task can be fulfilled lies in whether we can emancipate our minds and relax our policies. Over the past 30 years and more, though we called for planting trees every year, why did the work still develop slowly with many barren hills remaining unchanged? An important reason is that some of our policies, regulations and systems do not comply with the developmental level of our productive forces and our work is hampered by old practices and conventions. For example, we have unduly emphasized large-area afforestation to the neglect of planting trees in a scattered way and have unduly emphasized relying on state and collective strength to the neglect of incentives for individuals to plant trees. In the last 2 years, with adoption of the responsibility system of linking agricultural payment to output, the sluggish forestry situation has been broken through; some barren hills which have lain fallow for many years are now contracted to commune members for planting trees or assigned to them as private hills. Large numbers of specialized and key households engaged in raising seedlings and planting trees, together with various tree-planting combination bodies and afforestation contract service companies, have sprung up in these circumstances. People in some places have broken the bounds of different trades and localities and cooperated in afforestation. All this will speed up the work of afforesting barren hills and building a ecological protective screen and these new things are indeed inspiring!

Some of our comrades tend to look at problems from an old viewpoint. They fear that if too many barren hills are contracted to peasants, it will be difficult to adhere to the socialist road. Therefore they take a skeptical and wait-and-see attitude and are unwilling to go ahead boldly with this work. It must be fully affirmed that assigning or contracting barren hills to commune members for planting trees according to their management capability is a new form of running the socialist cooperative economy. It is a creation of Chinese peasants under the leadership of the Communist Party for developing forestry. We must value the masses' initiative and enthusiastically support new things in this field. We should explicitly announce that forests belong to people who plant them and these people have the right to bequeath the forests they plant to their children. We should promptly study and solve existing problems and go all out to mobilize the great amount of surplus rural labor force to develop barren hills. When we strive to make barren hills green, we should, at the same time, continue to restore and develop old forestry bases and do a good job in their regeneration. We should establish various responsibility systems for forestry production and actively adopt methods of bearing responsibility by production units for their profits and losses. We should envigorate state-run and collective-run tree farms in their business, earnestly protect existing forests, and resolutely prohibit random tree-felling.

In short, policies for planting trees on barren hills must be relaxed; management of existing forests must be tightened: and thus, with a steady increase in afforested area, we will gradually build up a fine ecological protective screen.

To ensure that the important task of planting trees and building an ecological protective screen may be effectively carried out in future years in a down-to-earth manner, we must carefully handle our work in all aspects and achieve good results from one area to another. 1) We should properly work out tree-planting plans so as to avoid blindness. When choosing suitable varieties of trees and other plants, we should base our plans on local soil, climate and other natural conditions. We should combine voluntary tree-planting activity with daily tree-planting work and link the planting of trees to the development of agricultural, forestry and animal husbandry production, the building of farmland, gardens, roads and other parts of our living environment, and urban construction and the building of Army barracks. 2) Guidance should be given to different areas. For example trees, shrubs and grasses should be planted together in the Northeast, North and Northwest Regions where soil erosion is serious and sandstorms are frequent. Fuel forests should be planted in rural areas where there is a shortage of energy. In cities, stress should be laid on voluntary tree-planting activities and ornamental plants should be grown so as to beautify our urban environment. In remote mountainous areas and deserts we should conduct aerial sowing and mechanized afforestation. All this should be planned and arranged according to specific conditions in various areas. 3) Special efforts should be made to prepare seedlings. The state, the collective, the department and the individual should all be encouraged to raise seedlings. We should strive to meet demands with seedlings raised locally. State-owned and collective seedling farms must be run well. Specialized peasant households and other individuals in both rural and urban areas should be encouraged to raise seedlings. The supply of seedlings should be properly organized. 4) It is necessary to establish and practice -- according to local conditions, a responsibility system for planting and managing trees with planters' rights, duties and benefits being linked and to establish a feasible system for inspection and for awards and penalties. We should pay special attention to the management and protection of newly planted trees. 5) Scientific methods must be used in the work of planting trees and technical guidance should be strengthened. Technical service contracts should be properly handled. We must resolutely correct the previous tendency of unduly stressing quantity to the neglect of quality, ensure that trees may survive and grow into useful timber and achieve economic and ecological benefits from afforestation.

This year is the second year of the national tree-planting movement. The Central Commission for Afforestation requires: In cities, priority should be given to planting in scenic spots, major avenues, factory gardens, government organs and schools and other public places. There should be some basic changes in the appearance of cities where provincial governments are located within 5 years. In the countryside, people should plant trees around their villages, houses, fields and along roads as soon as possible. In particular, they should pay attention to the building of farmland shelter belts. In brief, carrying out the work of planting trees for a long time and building up a fine ecological protective screen is an established national policy in China. This is not only an issue concerning the economy and spiritual civilization, but is also an issue concerning the environment in which our nation is living. So it is related to our nation's prosperity. We must devote great efforts to this work for 20 to 50 years and strive to achieve better results year after year.

CSO: 5000/4170

SICHUAN BEGINS SPRING AFFORESTATION ACTIVITIES

Chengdu SICHUAN RIBAO in Chinese 21 Feb 83 p 1

[Text] All localities of Sichuan Province are seriously implementing the spirit of the All People's Voluntary Tree-planting National Work Conference. On the basis of carrying out preparation work, the tasks of spring tree-planting have gradually begun. The cadres and masses are determined to do a solid job to improve afforestation results.

According to the understanding of the Provincial Afforestation Committee, meetings of commendation and mobilization for tree-planting and afforestation were held before the Spring Festival in the counties of Chengdu, Leshan, Yibin, Nanchong, Daxian, Yongchuan, Ya'an, Zigong, etc. In some of these places, meetings of the heads of counties, bureaus of forestry or commune party secretaries were called to relay the spirit of the All People's Voluntary Tree-planting National Work Conference, to summarize and review the work of last year, to commend the advanced workers, and to plan this year's afforestation tasks. The meeting in Chengdu stressed this year's tree planting project, aiming to do it well, to do a solid job, to build a foundation of sapling nurseries, and to produce results through care and management; the spring afforestation program was divided into various stages. Leshan Prefecture demanded that each of its counties make the best use of time; more than 70 percent of the entire year's afforestation projects must be completed before the end of February; during March, it made a concentrated effort to plant seedlings and continued to implement the "Emergency Directive" of the Central Committee and is completing the rounding-off job of the "two systems" in forestry. Actions began early in the cities of Chengdu, Wenjiang, Leshan, and Ya'an, and more than 29,000 mu have been afforested and more than 39 million trees have been planted on the "four sides". More than 150,000 shrubs and flowering trees have been planted in Chengdu City. Wenjiang Prefecture has planted 65 million saplings this year. The family of the party branch secretary of Yushe Brigade, Yushe Commune, Wenjiang County planted more than 2,000 trees. The agencies and troops of the counties and the prefecture of Nanchong first inspected the afforested sites of past years before carrying out the afforestation project for this year, they also visited the model sites of the prefecture. A total of 17,000 persons have been mobilized. Trees have been planted on more than 600 mu of barren mountains nearby a brigade of Chengguan Commune, with management and protection agreements signed by commune members of the vicinity to

guarantee the project to stay unchanged for 3 years. The party and government leaders of Tongliang and Hejiang counties, etc., all brought cadres of their agencies with them to participate in the tree planting activities.

6248
CSO: 5000/4153

FORESTRY PROMOTED ALONG HUANG HE BASIN

OW241435 Beijing XINHUA in English 1351 GMT 24 Mar 83

[Text] Xian, March 24 (XINHUA) -- Indiscriminate felling of trees and reclamation of pastures has been basically brought under control in most areas in the upper and middle reaches of the Yellow River, which used to suffer from serious water and soil erosion.

In 1982, efforts were stepped up to implement the "Regulations for Water and Soil Conservation" in Shaanxi, Gansu, Shanxi, Qinghai and Henan Provinces, the Inner Mongolia Autonomous Region and the Ningxia Hui Autonomous Region.

Meanwhile, the responsibility contract system was widely adopted for conservation work, said a spokesman for the Xian-based conservation administration for the middle reaches of the Yellow River. In the five provinces and two autonomous regions, he said, people planted trees on 480,000 hectares and grass on 160,000 hectares last year. As a result, the spokesman added, water and soil erosion was brought under control on more than 7,580 square kilometers, overfulfilling the annual quota by 75 percent.

The upper and middle reaches of the Yellow River covering the bulk of the Northwest China loess highlands used to be covered by trees in ancient times, according to historical records. Excessive felling through the ages stripped large tracts of vegetation, causing fabulous amounts of top soil to be washed into the Yellow River.

CSO: 5000

CHINA INCREASES NUMBER OF NATURE PRESERVES

Beijing GUANGMING RIBAO in Chinese 9 Jan 83 p 1

[Article: "Number of Nature Preserves in This Country Increased to More Than 100"]

[Text] As of the end of 1981, the total number of nature preserves in this country had increased to more than 100 from the 1981 figure of 85.

The establishment of nature preserves is proceeding rather rapidly, primarily because the relevant local leadership departments are approaching the work involved seriously. The number of nature preserves in Guangdong Province has already increased to 15, including 9 on Hainan Island. In order to intensify the management and establishment of nature preserves, last October the provincial forestry office held a conference to sum up existing experience and propose methods of solving problems that have arisen. More local-government-approved land designation plans are being worked out. Henan Province, which initially had only 1 preserve, approved 13 in 1982 and allocated funds to support the development of work involving the preserves. On the basis of the requirements of agricultural development and protection of rare tropical and subtropical animals, the Guangxi Zhuang Autonomous Region has designated 52 water-resource forests and wild animal and bird sanctuaries and is establishing these in stages.

As a result of the increased number of preserves, their variety is gradually increasing. Jiangxi Province has established the Jing'an County giant salamander preserve and has taken steps to protect this animal, which used to be freely hunted as a delicacy. The Karamali Mountain preserve established by the Xinjiang Uighur Autonomous Region is currently one of the country's largest, with an area of more than 1.4 million hectares, and is serving as a protection and accumulation area for such hoofed animals as the Mongolian wild ass, the gooseneck antelope [ehouling 7709 0814 5024], the argali and the like. The Leigong Mountain preserve, newly established in Guizhou Province, is intended to preserve our country's precious bald China fir forests. The Xingdoushan nature preserve set up in Enshi District, Hubei Province, protects the dove tree, Chinese tulip tree, tricuspid Chinese fir, the Lianxiang [6647 7449] tree, the Zhong'e [6988 5501] tree and other precious ancient tree resources.

In some previously established preserves such as the Wuyishan, Wolong, Changbaishan, Dinghushan, Baishuijiang, Foping, Fenglin, Fengyangshan and other nature preserves, management and research work is being pursued in keeping with our country's specific conditions, and some initial progress is being made in developing methods for this work. The necessary research organizations have been established for some rather large nature preserves, and with the participation and guidance of the relevant scientific research and educational units, some special research topics are being pursued.

8480
CSO: 5000/4121

BRIEFS

SHANXI TREE-PLANTING ACHIEVEMENTS--Shanxi Province, as of now, has planted over 500 million trees on the fringes of villages and by roads, lakes, ponds and houses. If the growth of these trees is normal the province has created a 13-million-cubic-meter timber reserve, accounting for one-fourth of the province's total volume of timber in reserve. [Text] [Taiyuan SHANXI RIBAO in Chinese 9 Mar 83 p 1 SK]

CSO: 5000/4168

SOLUTIONS TO HEAVY METAL POLLUTION CAUSED BY SLUDGE SUGGESTED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 2, 1983, p 15

[Article by Xia Zenglu [1115 1073 4389]: "Beware of Heavy Metal Pollution Caused by Sludge"]

[Text] In China, the agricultural utilization of sludge has had a long history. As sludge contains a fairly good amount of organic substances as well as nitrogenous and phosphonic nutrients, it is conducive to soil texture improvement; it can also help to adjust and supply the nutrients and water needed by farm crops, and help to improve harvests. Thus, it has always been welcomed by peasants. In the Beijing district, besides digging up sludge in ponds, rivers and lakes, the peasants also make use of sludge deposits from sewage treatment plants, and have achieved excellent results. But due to the lack of knowledge about pollutants in sewage plant deposits, especially about the excessive heavy metal contents, the excessive application of sludge over many years has brought about serious pollution in some farmlands, and light to medium pollution in others, which has aroused great concern. Moreover, with the development of the four modernizations, Beijing plans to build some sewage plants which will greatly increase sewage sludge deposits. What are we going to do with the vast quantities of sludge after these plants have been built? How are we going to properly utilize the sludge and not pollute the environment? These are some of the problems we face today and will have to reckon with in the future.

In foreign countries, there are three ways of dealing with pollutant sludge: (1) dump into the sea; (2) dewater, burn, and bury; (3) use as soil fertilizers. The first method is chiefly used by coastal cities in Europe and the United States. In places far from the sea coast, it would entail tremendous transportation costs and is, therefore, unsuitable. Moreover, the sea is now no longer believed to be a safe container for depositing pollutants. Thus, this method is no longer considered safe. The second method requires construction of extra plants for processing, which not only requires more capital investments and operational expenditures, but also more energy consumption. Moreover, burning could also give rise to air pollution. Thus, it is not the best method either. The third method is a way to reuse material and energy sources; it is not just passive treatment, but rather the combination of utilization and treatment, and has become

fairly extensively-used experimental method. But it involves a certain amount of risk; under certain circumstances due to lack of knowledge and improper use, it could cause serious soil pollution and affect human and animal health. It is reported that in 1970, approximately 50 percent of treatment plant sludge in England were utilized in farmlands, and only 3 percent were burned. It was estimated that the proportion of sludge for farmland use in England would gradually increase by 1980, and sea dumping would decrease to approximately 10 percent. Now, standards for the agriclutural use of sludge have been established in Holland, Norway, Sweden, Denmark, the United States and England. With the further development of research on farmland use of sludge, we can expect to see more use of this kind of sludge in agriculture.

In the Beijing district, heavy-metal pollution of soil is chiefly found in such places as Gaobeidian and Wangsiying in the eastern suburb, and along both banks of the Xinkai Canal in the Western suburb. The pollution is largely attributed to the use of sludge. In the eastern suburb, sewage plant sludge deposits are applied to farmland in Gaobeidian, using as much as 10,000 to 20,000 jin per mu. In the western suburb, sludge is dug out from the bed of the Xinkai Canal and saved for farmland on both banks of the canal. According to surveys and studies, sludge can cause heavy metal pollution to farmlands at a much higher rate than sewage water irrigation. For example, in Gaobeidian Prefecture, the amount of mercury put into soil by use of sludge each year is 16 times greater than sewage water irrigation. Thus, sludge can cause pollution at a very alarming rate. Actually, based on studies on mercury pollution in Gaobeidian Prefecture, the maximum number of allowable years for the use of sewage water irrigation is 144 years (i.e., before serious pollution develops), whereas the maximum number of years for sludge is only 12. Survey shows that more than ten years of sewage water irrigation and sludge application in the region have caused the soil's local mercury level to exceed the soil's local capacity. At present, although some of the soil in the region is only suffering from medium-level pollution, the pollution is continuing to develop and will reach the soil's environmental capacity in no time. We should also take serious account of the rapidly developing cadmium pollution of the soil which has already reached a serious level in a few places, and medium level in most of the region. Thus, the use of sludge in these districts has become a problem which has to be urgently solved. In recent years, owing to the enforcement of regulations to control major plants which discharge mercury, the mercury contents in sludge has dropped from 40-50 ppm to below 10 ppm. But as the mercury in the soil in these areas has already reached a very high level, and sludge is still being used in great quantities, plus the fact that the use of sludge is not being controlled in any way, the pollution of the soil by such heavy metals as mercury and cadmium is still in an accumulative stage, and the pollution is growing. Study of the preceding problems shows the follwing main causes:

1. Inadequate understanding: Following the "Survey on Environmental Pollution in the Southern and Eastern Suburbs of Beijing, and Study on Ways of Prevention and Control," some people may have gotten the idea that since Beijing's soil is calcareous and slightly alkaline, and the soil has

fairly large heavy metal capacity, it is worthwhile to continue using the soil as a kind of sewage water treatment system or using sewage water for farmland irrigation. This kind of understanding is based merely on the results of sewage water irrigation. But it does not mean that we can overlook the heavy metal pollution problem in the region. Actually, the survey report does warn against heavy metal pollution caused by improper use of sludge. Some soils are so badly polluted that such measures as soil improvement or switching to other kinds of crops are required. Some soils also require prevention against further heavy metal pollution. Besides, the comparatively large soil capacity due to the characteristics of the soil in this particular region is merely a relative concept. The fairly large capacity is attributed to the fact that some of the harmful metallic elements are temporarily fixed by the soil, and cannot be absorbed or retained by crops. But as we all know, just as the soil is being contaminated today, the nature of soil can also be changed under certain conditions attributed to intensive human activity. If human activity causes the local soil to change from weak alkaline to acidic, the harmful metals which were originally fixed by the soil and difficult to be absorbed by crops will graudally become active and increasingly dangerous. Hence, soil which are believed to be affected by medium-level or even low-level pollution will eventually become seriously contaminated. The soil's capacity will fall. When this happens, we will not only become extremely cautious about the use of heavy metal contaminated sludge, but perhaps even concerned about some of the heavy metals in sewage water irrigation.

2. Research kept apart from management: Based on the law of the balance of materials, the joint group which was involved in the "Survey on the Environmental Pollution in the Southern and Eastern Suburbs of Beijing, and Study on Ways of Prevention and Control," computed the accumulation rate of heavy metals [in the soil], and came up with recommendations on how much sludge can be applied, and which areas should stop continuing the use of sludge. But as the research results were kept apart from the management system, to this day, they have never been put to use.

3. The study report proposed that the application of sludge should not exceed 1,500 jin per mu; this kind of restriction is too steep and difficult to carry out in practice since sludge does not contain a high percentage of nutriments in the first place.

4. Except for use on farmlands, it is difficult to burn or dump into the sea. We have not come up with a better way for utilizing or treating sludge.

5. Based on the preceding reasons, the author proposes the following solutions:

1. Strengthen the link between environmental protection departments and agricultural production departments, and put research results to use in production practice.

2. In areas where the level of heavy metal content in the soil reaches the soil capacity, sludge deposits from sewage treatment plants should not be used as fertilizer any more. Steps should be taken to remove the heavy metal content and improve the soil; another alternative is to plant crops with low absorbing rates, or plant plants which are not involved in the food chain.

3. When soil has taken in a dangerous amount of heavy metal, we should either stop the use of the offending sludge or take corrective measures in the plant to keep the level of the contaminant in the sludge controlled to that of the soil's background content level.

4. Put an end to the cadmium source in Beijing Chemical Industry Plant No. 2 through internal corrective measures.

5. At present, there is a drive to beautify the capital city and other major cities across the country. We are urged to plant all kinds of trees and flowers; all kinds of inorganic fertilizer strips, bags of organic fertilizers and compost soils have appeared on the market. It is a welcoming sight to the urban residents. Sludge deposits from sewage plants can be made into organic fertilizer pellets and sold in bags on the market. The sludge can be put through a compacting process and directly manufactured into pellets; or it can be first used as marsh gas fuel prior to the manufacturing process. This type of fertilizer is characterized by long fertilizer effect, sufficient nutrients; it can improve the physical nature of soil, improve the air and water permeability of soil, and is not so odorous. It is an excellent and inexpensive high grade fertilizer suitable for flower plants in urban areas. This method can produce relatively high economic results; it is profitable and easy to use. Moreover, the method can be effectively used in scattered locations without contaminating the farmland or polluting the farm crops. It is a fairly good method.

9119
CSO: 5000/4148

ASSESSMENT OF DENSITY DISTRIBUTION OF METALS

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 1, Feb 83 pp 5-12

[Article by SUN Yulin [1327 3768 2651] of Jinan Municipal Research Institute of Enviromental Protection Science: "Calculation of Background Level of Soil in Jinan Area"]

[Summary] From 1 suburb and 3 counties of Jinan, 36 profile samples were taken from cultivated soils, including brown earth developed from parent materials of granite, sandstone, gneiss, etc., drab soil from limestone, diluvial, and loessial parent materials, and littoral soil from alluvial materials of the Huanghe, for analyses and processing to determine the soil background value and contents of the 20 elements of Hg, Cd, Pb, Cu, Zn, Co, Ni, Mn, P, Cr, Li, As, V, Ca, Mg, K, Na, Fe, Ti, and Al. The density distribution of metals in the soils was assessed. Of 34 profile points, the mercury content of topsoil is greater than that of the subsoil in 30 points to indicate a general and large-scale Hg pollution. Analyses of 81 samples disclosed Cd contents to be about 40 ppb, including the 14 samples taken from wastewater irrigated areas. It appears that in soils of high content of organic matter, the chelation action of the organic matter causes the mercury to accumulate in the topsoil.

6248
CSO: 500/4154

BRIEFS

EMISSION CONTROL OF NUCLEAR POWER STATION--On 8 December senior engineer Zuo Hu [1563 3275] of the Ministry of Nuclear Industry spoke on nuclear power safety at the provincial science auditorium. He said that radioactive material exists everywhere in nature. For example, cosmic rays, soil, buildings, radiation therapy, nuclear testing, etc., but nuclear power stations emit very little radiation, sometimes unmeasurable. A nuclear power station is different from an atomic bomb, the radioactive material in a nuclear power station is only 3 percent in concentration whereas the concentration of the radioactive material in an atomic bomb is as high as 97 percent. The reactor of a nuclear power station has four different shields, the effectiveness of these shields has been demonstrated by the fact that the Three Mile Island incident in the United States did not result in one casualty. The nuclear power station to be built in Qinshan in Zhejiang Province will apply the most advanced emission controls and the radioactivity released will be even smaller. After the report by Comrade Zuo Hu, a science education film on nuclear power was shown. This seminar on nuclear power was jointly sponsored by the provincial science association and the provincial building commission. Similar seminars will be held in the future. Comrade Zuo Hu will next go to Haiyan county, location of China's first nuclear power station, to disseminate and popularize scientific knowledge on nuclear power safety. [Hangzhou ZHEJIANG RIBAO in Chinese 9 Dec 82 p 1] 9698

SHANDONG POLLUTION CONTROL ACHIEVEMENTS--The Shengli oil fields as well as the oil refinery and Huangdao oil exploitation areas of the Qilu petrochemical general company are major polluters of the waters of the Bohai and Yellow Seas along the coasts of Shandong Province. According to statistics, these units turned out up to 40 million tons of oil-polluted water annually. In coping with this problem, the Shengli oil fields have built 15 stations that can dispose of 50 million tons of polluted water annually. In 1982, the oil fields totally disposed of their polluted water and recovered 30 million tons of water and 23,000 tons of oil. As for controlling water pollution caused by heavy metal, Qingdao, Yantai and other coastal cities have begun to collect pollution-control fees and have built many projects for disposing of metal-polluted water. As of now, the province has been able to basically bring under control the two kinds of water pollution. [Text] [Jinan DAZHONG RIBAO in Chinese 11 Mar 83 p 1 SK]

NATURAL GAMMA RADIATION INVESTIGATION--The Provincial Labor Health Research Institute has completed an investigation on the level of background gamma radiation in Liaoning's natural environment and the pattern of distribution. It has drawn a map of the level of environmental gamma radiation (including indoor and outdoor) taking the county as the unit in the province and a geographical distribution map. It summarized the level of natural gamma radiation and its relationship to geological structure, filling a gap in this area in our province. This investigation provided background information for future development of nuclear power and nuclear enterprises in Liaoning; it provided a scientific reference for studying radiation effects and for establishing standards for protection against radiation and environmental laws. This achievement was made by the Provincial Labor Health Research Institute after conducting an overall survey of the level of natural gamma radiation in Liaoning according to the plans drawn up by the State Scientific and Technological Commission and the Ministry of Health last year and on the basis of 20 years of monitoring and observation of pollution by artificial radioactivity caused by the use of radioactive isotopes and by fallout from foreign and domestic nuclear tests. [Text] [Shenyang LIAONING RIBAO in Chinese 18 Jan 83 p 1] 9296

CSO: 5000/4136

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